ELECTRICAL TIMES

THURSDAY, FEB. 9, 1950

VOL. 117 NO. 3050 EST. 1891

6D

Cut-out for Rural Development

Rural development schemes, largely serviced from overhead lines or H.S.O.S. distributor cables, need specially designed cut-outs.

The B.I.C.C. range of All-Insulated Cut-Outs includes a double pole model, without sealing chamber, specifically produced for use with overhead services, and designed for convenience of installation.

They are non-ignitable, corrosion-proof and made for standard dimension high-breaking capacity fuses. When fitted with B.I.C.C. "E" Type Fuse Links maximum discrimination is achieved against sub-circuit fuses.

Write for Publication No. 232T. It gives further information and details of types and sizes of BICC All-Insulated Cut-Outs.

Cut-Outs and fuse-links are available at all our Branches.

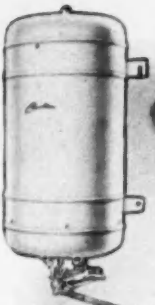
SPECIFICATION

All - Insulated Cut - Outs are made with single or double terminals, top and bottom, and are designed to take fuse-links for 15, 30 and 60 amps.

B.I. Callender's

ALL-INSULATED CUT-OUTS

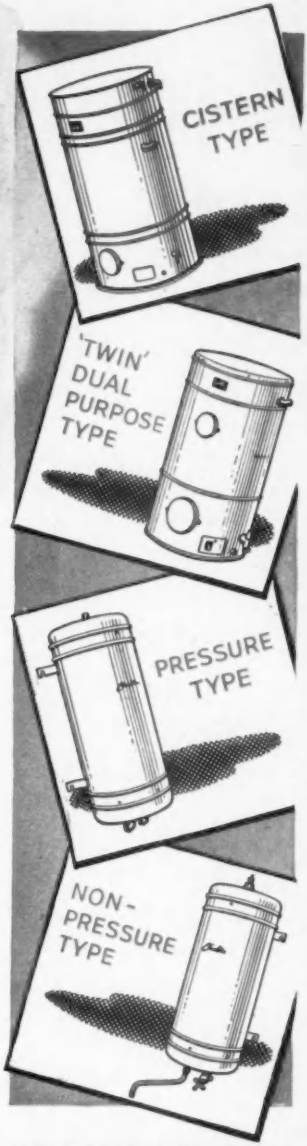
BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE NORFOLK STREET LONDON W.C.2



Reduction in

THIS STEAM MEANS BUSINESS

Purchase Tax



THE reduction in Purchase Tax will release some of the pent-up demand for B.N.E. *Charlton* Electric Water Heaters. Make sure you get your share of the business by ordering a range of these attractive and efficient heaters now—they are designed to meet every purpose and are available immediately from any B.N.E. depot* while stocks last.

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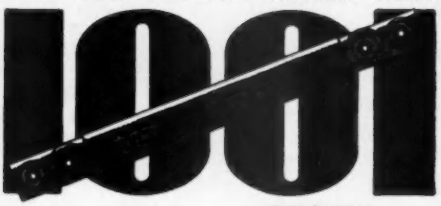

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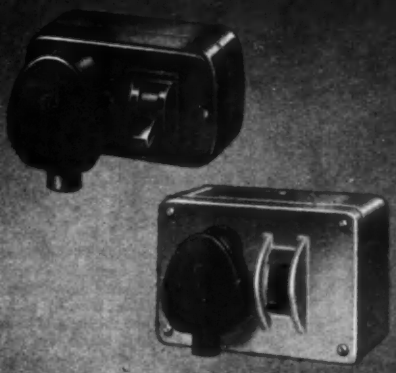

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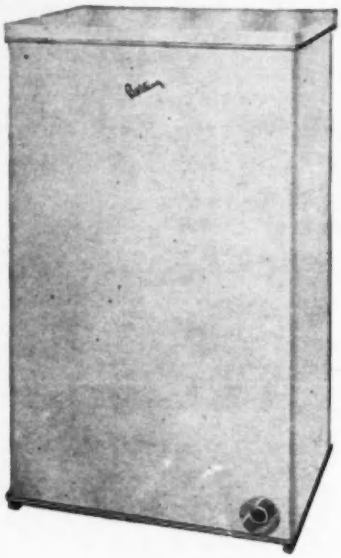

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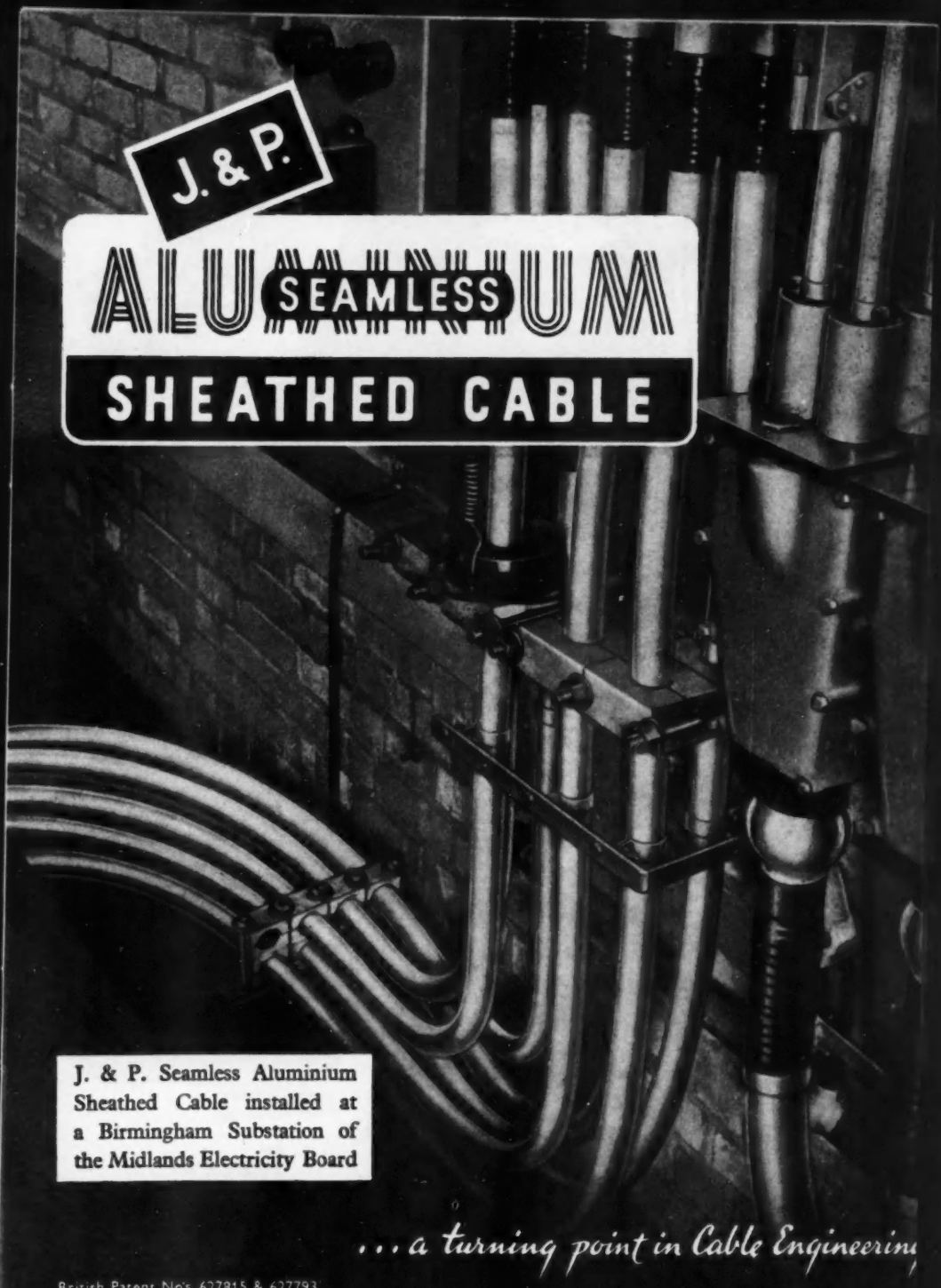

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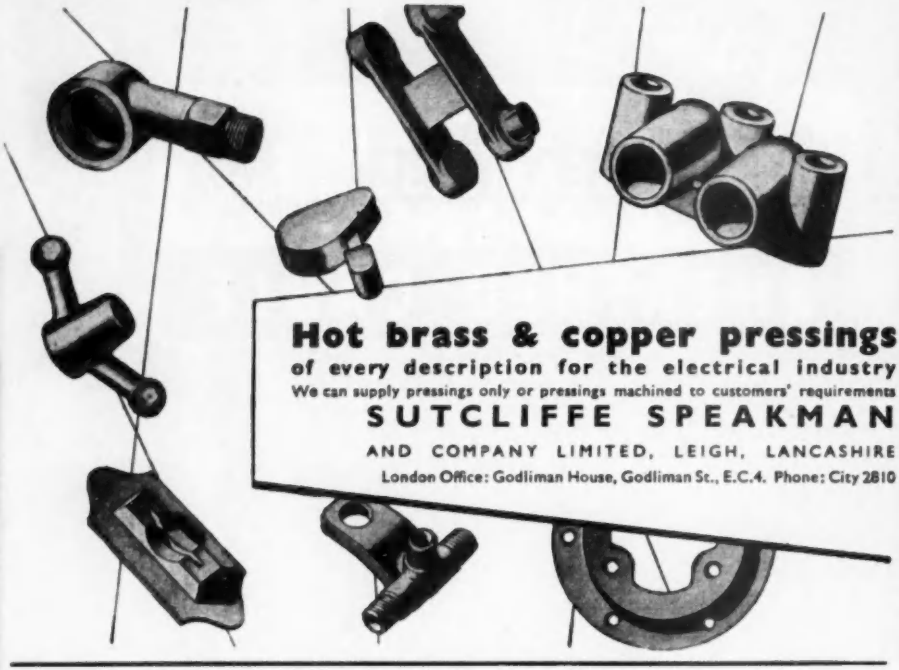

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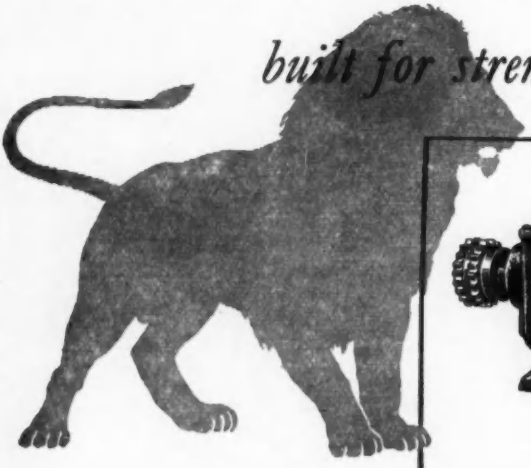

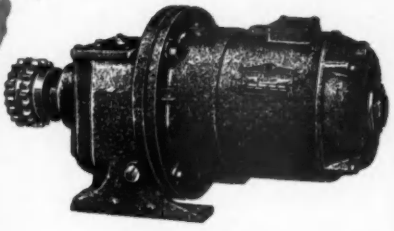

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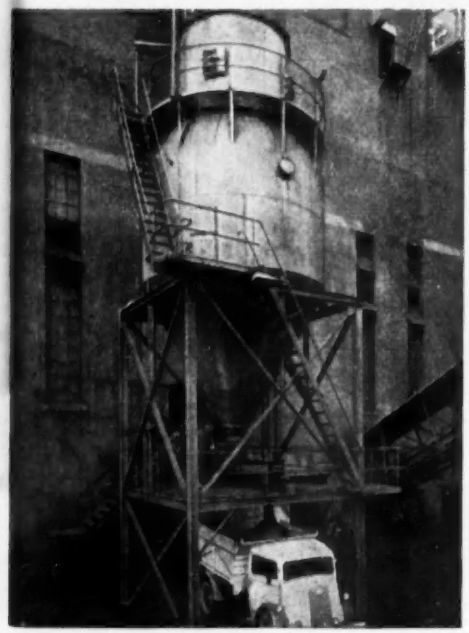

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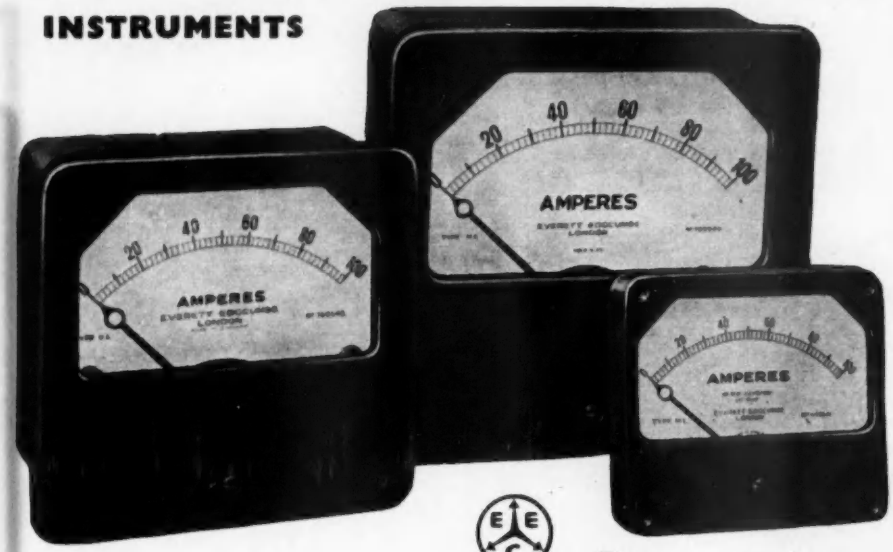

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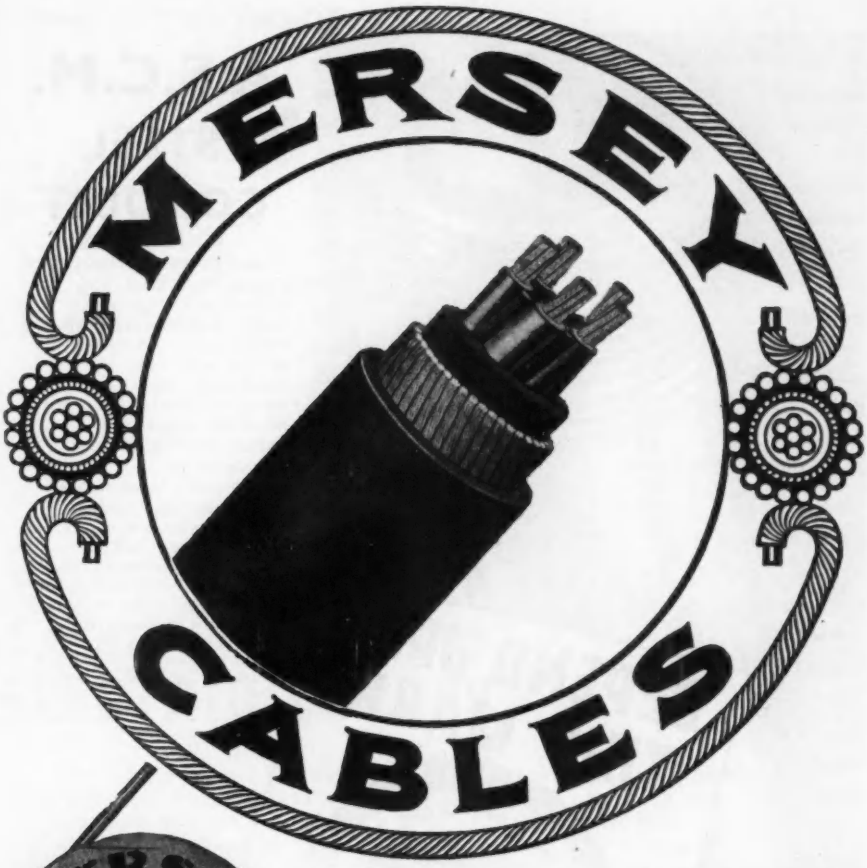

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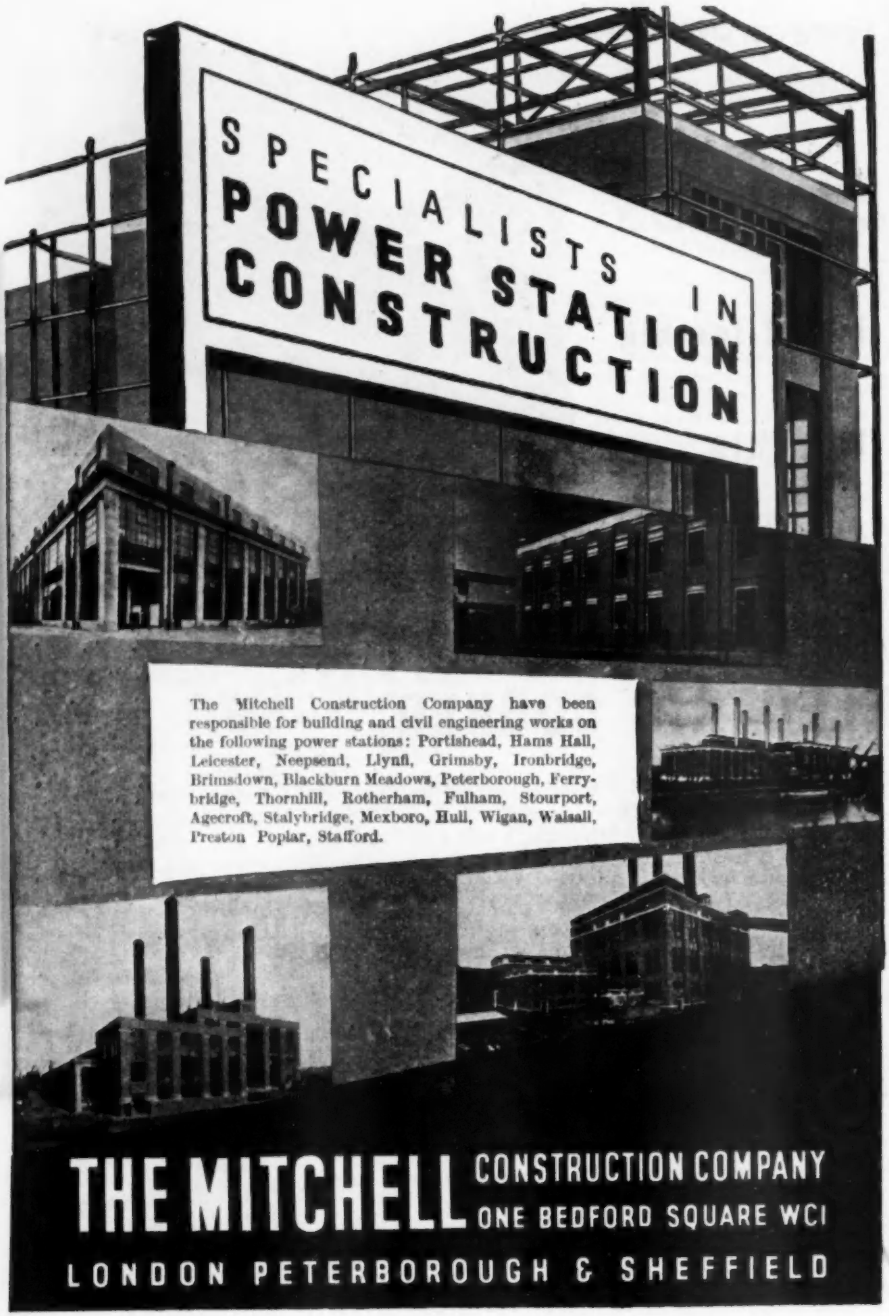
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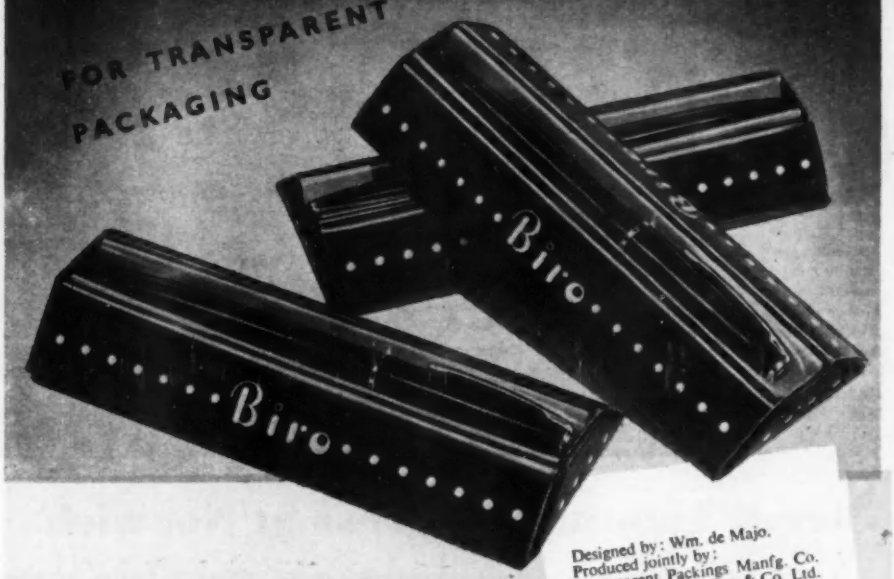

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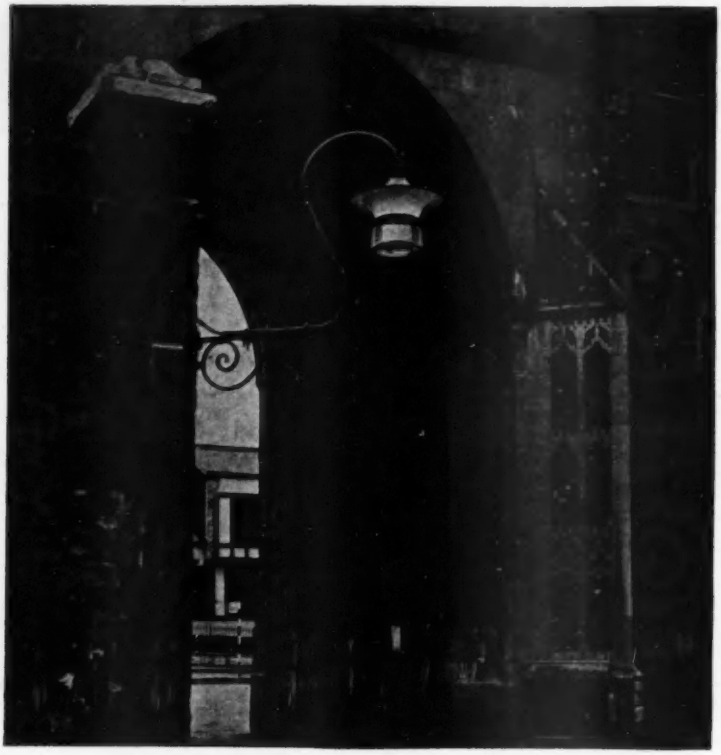

Rythmatic street lighting relay installed in Cathedral Close, Norwich, showing how it neither mars nor detracts from the beauty of famous historic buildings.

Street Lighting progress at Norwich

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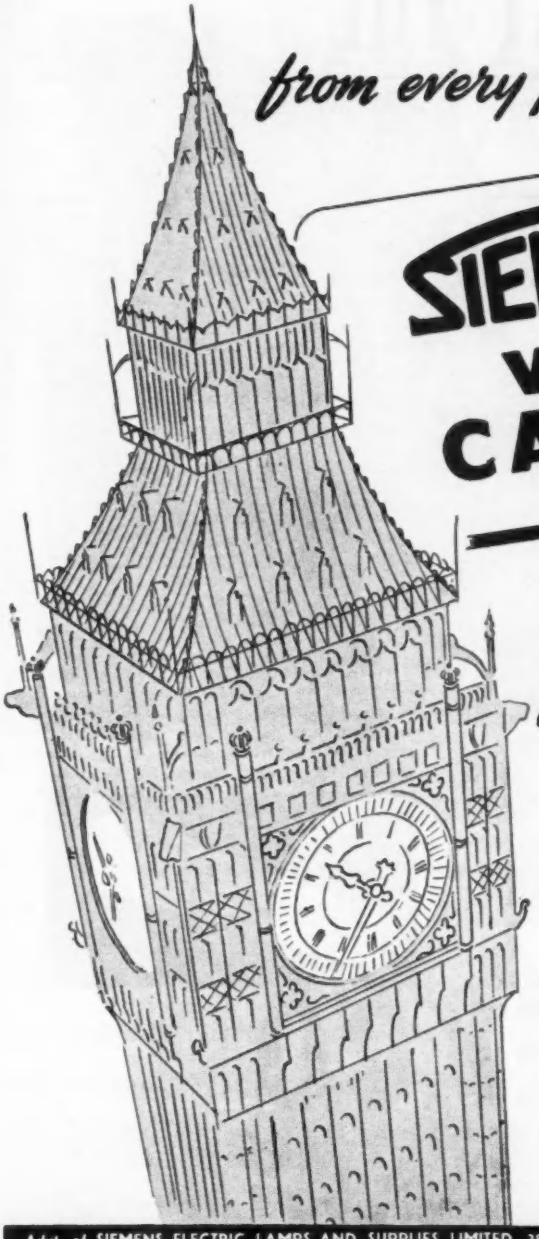

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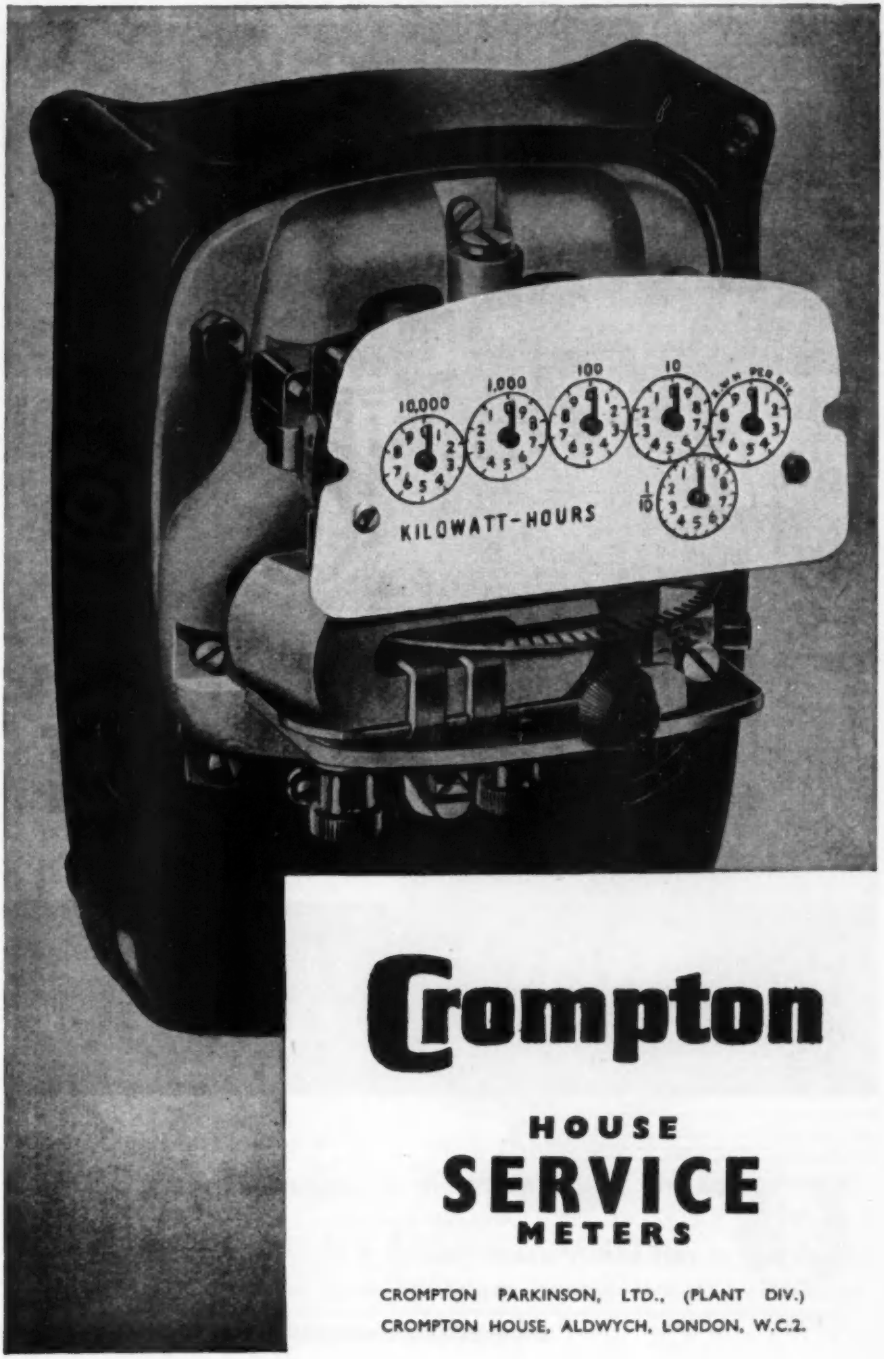

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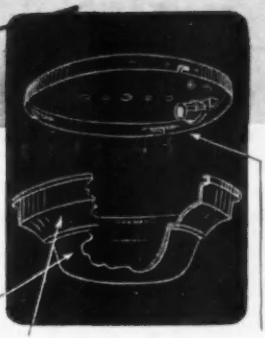

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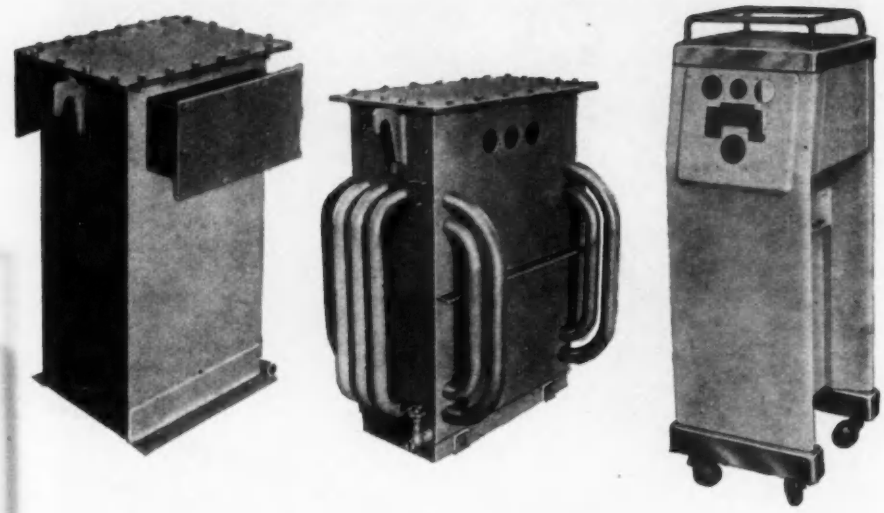

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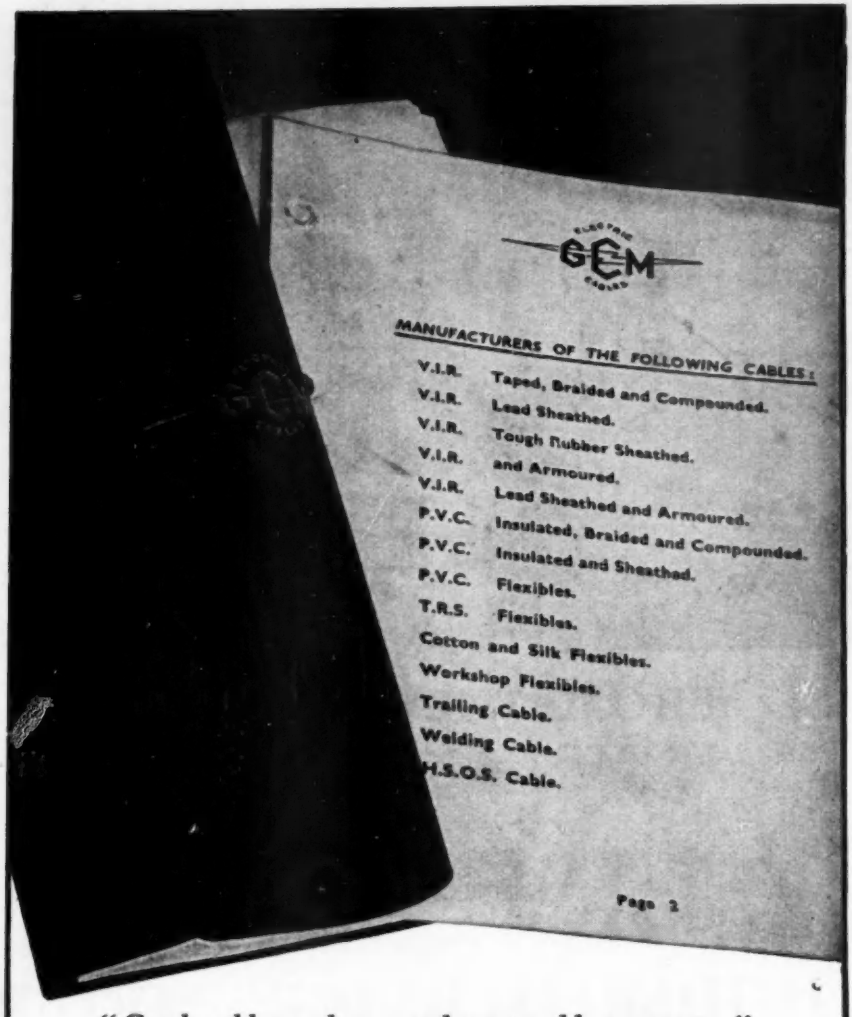

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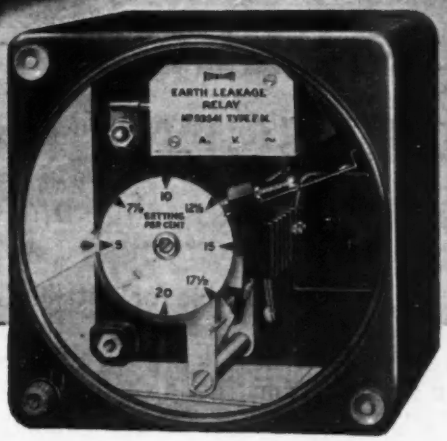

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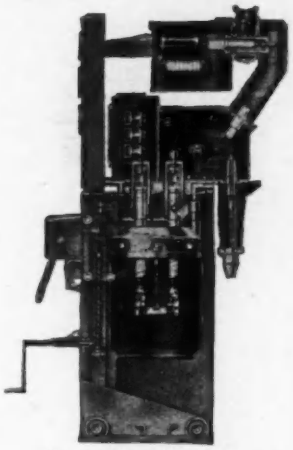

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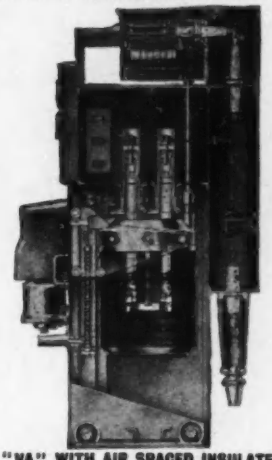

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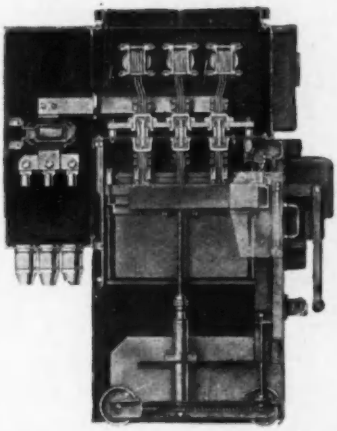

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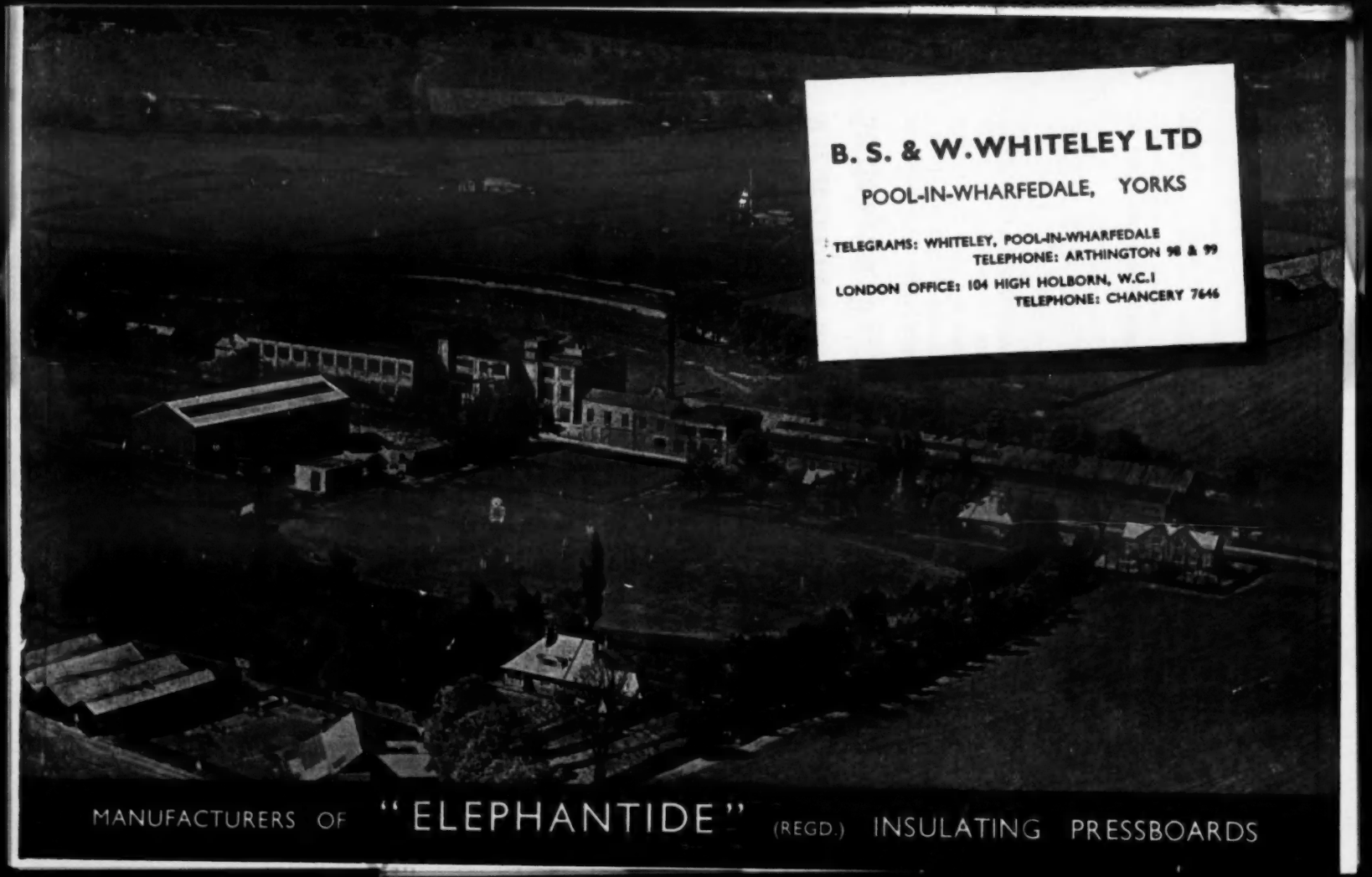
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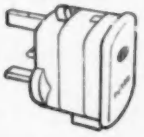

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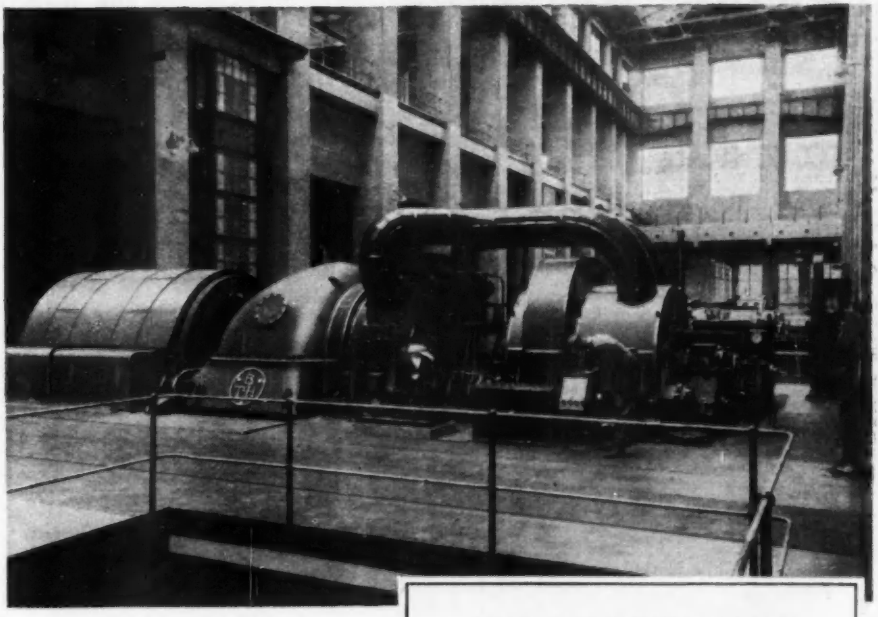

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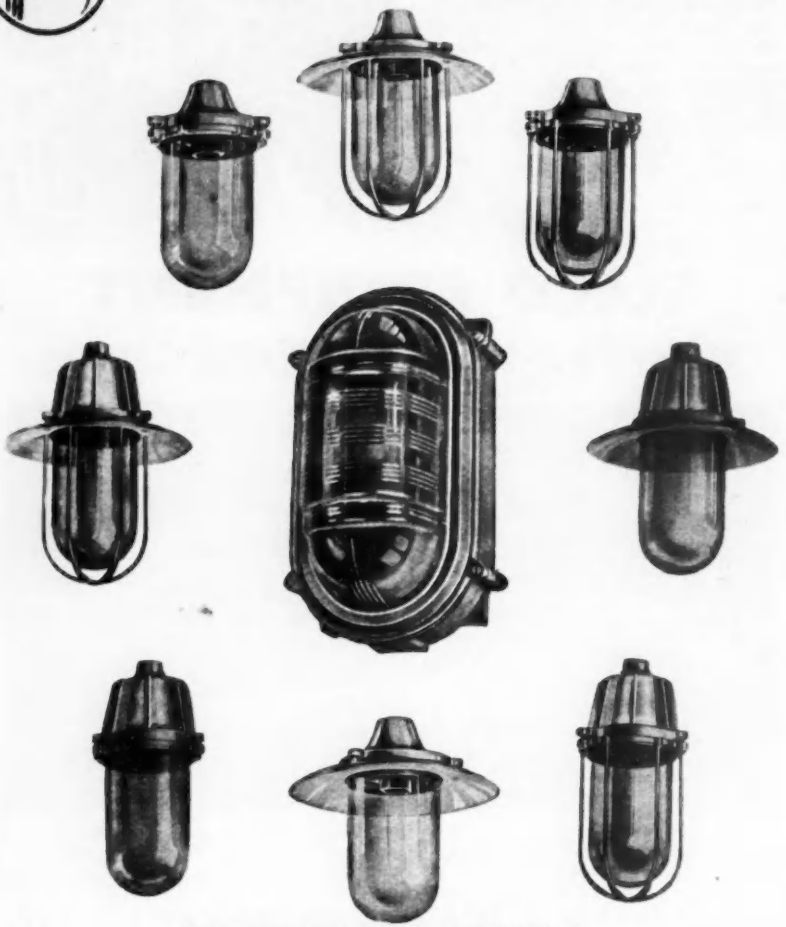

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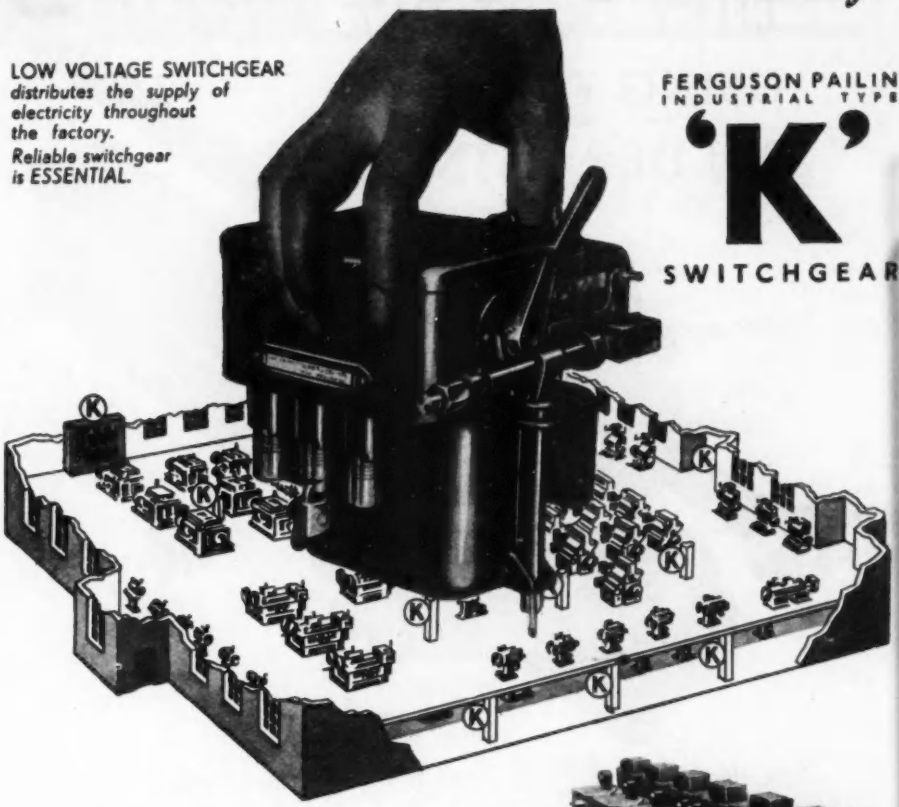

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ELECTRICAL TIMES

Vol. 117 No. 3040 THURSDAY, FEBRUARY 9, 1950

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● Telephone: HOLborn 6016-9. ● Telegrams: Equivolt, Estrand, London

PUBLISHED EVERY THURSDAY

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Volume 117 No. 3040 ELECTRICAL TIMES Thursday, February 9, 1950

EDITORIAL

A.M.I.B.E.A.?

MANY in the industry have not yet awakened to the full implications of the I.E.E. ban on correspondence courses in qualifying for Associate Membership. Amongst the first to do so were the power station shift workers, who feel that they have been hardest hit of all. A letter in our correspondence columns last week even went so far as to forecast an eventual shortage of shift workers due to the reluctance of men to take on positions which denied them the opportunity to qualify. It seems to be felt amongst those concerned that there is a case for the B.E.A. to introduce its own qualification, and the Coal Board's "Ladder Plan" has been instanced as an example to follow. This, of course, is a false analogy, since the Coal Board has merely implemented previous recommendations and instituted National Certificates—a step taken by the engineering profession some twenty-five years ago. It is unlikely that the B.E.A. will originate its own qualification, however desirable it may appear upon the surface. Such a course would tend to cause friction between itself and the I.E.E.; it could carry a professional status no higher than the degrees conferred by what our American friends call "fresh water" universities; and it would completely cut off the holder from other sections of the electrical engineering profession, tying him to generation all his life.

Shift Workers' Classes

IN any case, it is a mistake to assume that shift workers are automatically debarred from attending classes. It is true that no directive has been issued by the B.E.A. on this matter, but it seems to be generally understood that shift rotas shall be arranged with a sympathetic eye to those with ambitions to qualify. Obviously no rota can be arranged to suit every individual case, but most of those who have a genuine desire to attend classes can manage a majority of them, if not all. The "man up top" has usually a keen sense of his responsibility towards his shift staff and their needs in this direction. After all, he has been through the mill himself.

Series or Shunt

SWEDISH engineers are taking a bold step forward in their use of a series capacitor on a 220 kV line, since 66 kV is the highest voltage on which this form of correction has previously been applied. The further step to 380 kV will provide even more spectacular performance, the calculated increase in transmission capacity of a 375 MW line being no less than 120 MW. While the series capacitor is of considerable technical interest to British engineers, the possibility of its use in this country seems rather remote. It is true that we could benefit from increased capacity on certain lines, but we are not faced with the problems of system stability to the same extent as are the Swedish engineers, with their longer lines, and compensation could, therefore, be carried out using the more familiar shunt connected synchronous condenser, which would, in all probability, be much cheaper than the series capacitor. The Swedish 220 kV installation, with its elaborate insulation arrangements involving the suspension of over 100 tons in mid-air, costs approximately the same as 15 miles of 220 kV transmission line.

What is the Rating?

NOTES by "Megohm" on cooker wiring (January 26) are this week the subject of comment from a reader. Studying both notes and comments, two separate issues seem to be raised. The first question is: why does Post War Building Studies No. 11, although having I.E.E. members on the committee, recommend a standard lower than the I.E.E. Rules? The answer is, in our opinion, that the Post War Building Studies were compiled on a "practical minimum" basis, whereas the I.E.E. rules represent a counsel of perfection. Support for this viewpoint is given by the fact that it was found possible to relax the stringency of the I.E.E. rules during wartime. Now cables are inanimate objects, not sentient beings who will consciously do a little bit extra for the war effort. If it was permissible to raise the ratings as an emergency measure, there must have been something in hand. The other point is, of course, the permissibility of assuming a diversity factor in calculating cooker loading. While very few people will admit that a cooker is ever used full on, the fact remains that it is still a possibility. There would also be a difficulty in allocating a diversity factor, since it would vary with the size of cooker. Having due regard to all the difficulties, it is probably best to leave things as they are.

Brighter Accessories

IN this era of standardisation it is a pleasure to look back on those pre-war catalogues that showed electrical accessories in what now seems like a profusion of colours. While dealers may have found the variety an embarrassment, it did provide the user with an opportunity of harmonising lighting switches and sockets with general colour schemes and prevent them being a constant reminder of the utilitarian purpose they serve. The dreary choice of cream and brown which is offered today has all the semblance of wartime austerity. It is time, also, that exterior designs received more careful thought. Some firms, it is true, have made tentative efforts at improvement in appearance, but are these enough? Have not conditions reached a stage which calls for a radical alteration in basic ideas? As a first step, we would welcome a conspiracy of industrial designers to ban that old-fashioned monstrosity, the round surface switch.

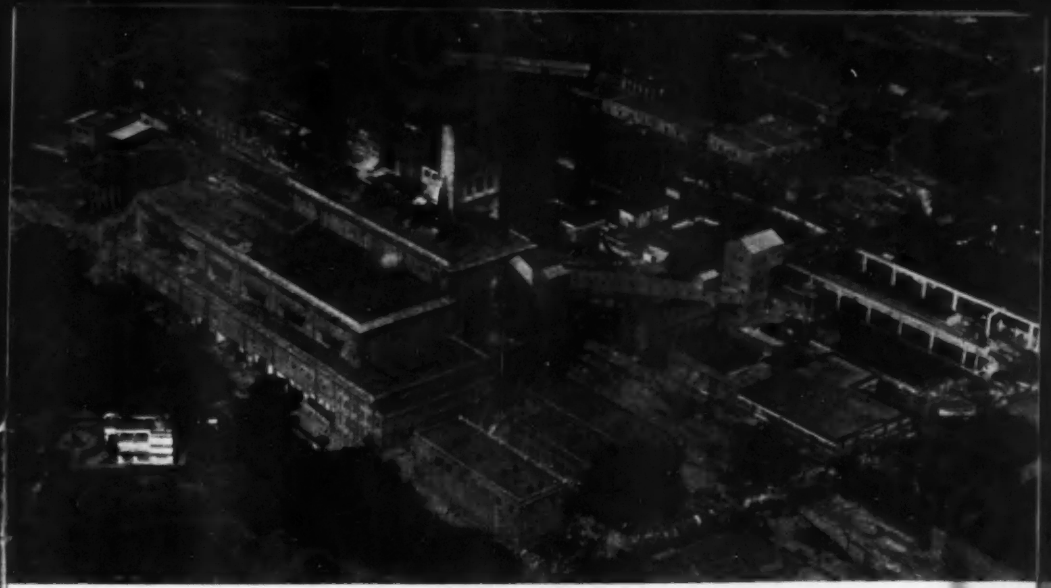
Regulations "Down Under"

FREQUENT reference has been made in these columns to the dangers of heavy short circuits at consumers' terminals and the difficulty of calculating the values likely to be obtained. We have before us a copy of the Service Rules issued by the Electricity Trust of South Australia, in which the problem is expeditiously dealt with. It briefly specifies that high-rupturing capacity units shall be used for all main fuses and any sub-circuit fuses of 50 amp or above when the installation is within 100 yards of a transformer of 500 kVA or larger. Many will feel that a rule of this type is arbitrary and unscientific. It has, however, the great advantage of being simple and direct, requiring no calculations or assumptions, and admitting of no argument. If we were to criticise, it would be on the grounds that it is, if anything, over-lenient.

English Repaired to Order

IAN HAY once referred to the laborious work of earnest undergraduates "translating a Greek not spoken in Greece into an English not spoken anywhere," and anyone who has ever waded through a literal translation of a foreign technical paper will admit that it can be heavy going. It is, therefore, good to learn that the British Council are arranging a scheme whereby Scandinavian technical papers written in English may be checked by British scientists working in the same field as the author. There is much of interest to be learned from Sweden, particularly on long transmission lines, and it is comforting to know that we shall not be confronted with an item such as a simple breaker handle masquerading under the alias of "equipage of command to hand."

Meteor



COSSIPORE

New Station at Calcutta adds 110 MW to Pakistan Resources

THE Cossipore site at Calcutta has been a power station location for over 38 years, the first station having been opened in 1912, when its capacity was 15 MW. Extensions and replacement brought this up to its present size of 50 MW, but with the rapid development of load the Calcutta Electric Supply Corporation Ltd. decided in 1938 to proceed with the erection of a new station on the same site capable of ultimate expansion up to 210 MW. The first part of the station, comprising two 30 MW sets and one 50 MW set, was opened by His Excellency Dr. Kailas Nath Katju, Governor of West Bengal, on January 4.

Civil Engineering Work

The site is narrow with little room to spare, and considerable ingenuity was required to accommodate the plant on the site without interfering with the supply of power from the existing station.

The subsoil, as might be expected in the basin of a large slow-flowing river, consists of a series of clays and silts of medium to soft consistency incapable of supporting, without considerable settlement, loads greater than about half a ton per sq ft, whereas the anticipated weight distribution of the power station was about 1¼ tons per sq ft.

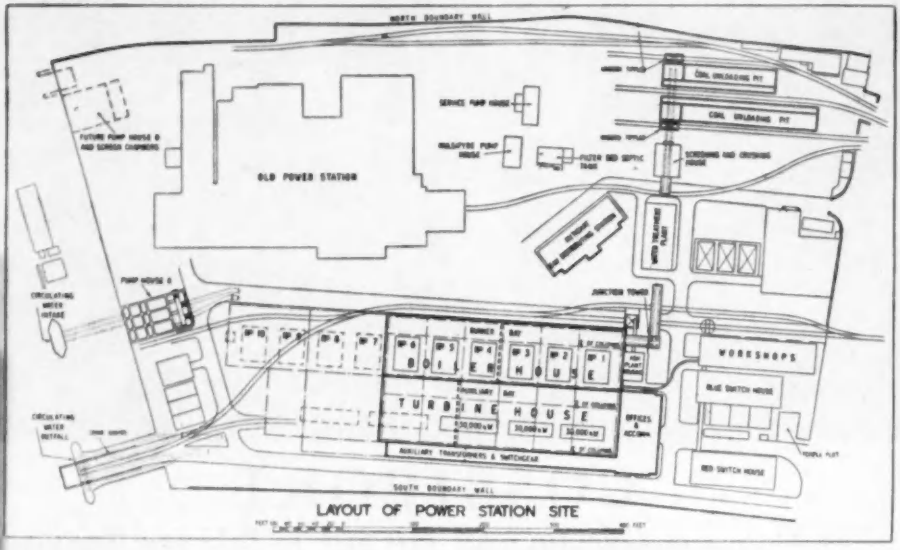
Examination of bore-hole cores showed no satisfactory stratum existed on which bearing piles could be supported. The principle adopted for the foundation, therefore, was to "float" the foundations in the surrounding earth. The whole area of the main buildings was excavated to a depth of 22 ft 6 in. and a cellular reinforced concrete raft built into the excavation.

In the turbine house the deck of the raft had to be omitted in order to provide space for the condensing plant; and to preserve continuity in the raft, the floor was made considerably thicker. This had the added advantage that it provided the weight required to resist vibration and earth tremors.

Originally the first stage of the station was designed to contain two 30 MW sets, but as the raft was nearing completion it was decided to add an extra 50 MW unit, and a second raft was therefore constructed. The two will be joined when they have taken up their final relative positions to give a structure 450 ft long by 229 ft wide.

The main power station building is a steel-framed structure 331 ft long and 172 ft 6 in. wide. The steelwork is composed of steel plate girders and steel columns of compound girder construction. Owing to the narrowness of the site, chimneys and fans had to be mounted on the boiler house roof, and since Cossipore is in a seismic area, it has been thought desirable to allow for horizontal loads caused by earth tremors. The total weight of structural steel in the building is therefore large—about 5,500 tons. The sections of the station on the two rafts are completely separated by an expansion joint and will remain so even when the rafts themselves are joined.

Offices and administrative buildings are located at the eastern end of the power house buildings. They include a fully equipped dispensary for first aid, a station laboratory for testing purposes and chemical analysis, and the main control room. At the same end, although separate, are two switch-houses erected on pile foundations.



LAYOUT OF POWER STATION SITE

Boilers

The boilers are arranged in a single line parallel to the turbine house, with the bunkers and firing aisle on the north side. Six boilers are being installed, but the design provides for extensions to include a further four units to complete the installation. The building is 81 ft wide, 108 ft high and is independent of the boiler supporting steelwork.

The boilers themselves are of the Babcock and Wilcox high head, single-pass type with a maximum continuous evaporation of 250,000 lb of steam per hour at 630 lb/sq in. and 825° F. The guaranteed efficiency is 89%. Fuel comes from the Bengal coalfields and has about 28% of volatiles and 17% ash. Bailey water-walls are fitted to the furnaces which are fuelled by the International Combustion Co.'s L-type travelling grate stokers, the grate itself being 30 ft wide by 22 ft long.

An unusual feature is that the forced draught fans draw air from the tops of the boilers. This has been done mainly to allow for adequate ventilation—a serious problem in hot climates.

Ash and clinker is discharged over the back of the travelling grates into a water quenching-trough from which it is removed by rotary paddles and fed on to a belt conveyor under the boilers. This transfers it to the feed hopper of a skip hoist which in turn loads it into bunkers for disposal. Dust from the dust collectors is airborne to a cyclone receiving hopper and is then wetted in a twin-screw mixer conveyor before joining the clinker in the disposal hoppers.

Coal handling is fairly straightforward, the lay-out of the handling conveyors being shown in the line drawings.

Turbine Plant

At present the construction of the turbine house is designed to accommodate two 30 MW and one 50 MW main turbo-alternators and one 2,500 kW house-service set. All were built by C. A. Parsons and operate at 3,000 r.p.m.

The 30 MW sets are of the two-cylinder type with four bled steam points for feed heating and evaporation. Final feed water temperature is about 340° F. The m.e.r. of these sets is 24 MW.

The 50 MW set is generally similar to the 30 MW units except that it has three cylinders, and an m.e.r. of 40 MW.

Whereas all these main units are condensing reaction machines, the 2,500 kW house-service unit is an impulse non-condensing turbo-alternator. This has been designed so that the station can be started up without the use of power from any outside source.

The condensers of all three main machines are of the single-shell type, so arranged that half the condenser surface can be cleaned with the other half in service. The alternators of all three main sets are capable of supplying full power between 0·85 lagging and 0·95 leading. They are of the high-voltage, concentric-conductor type, the voltage between the alternator terminals being 33,000 V. Cooling is by air flowing in a closed circuit, the air itself being cooled by water coolers.

Pilot exciters are fitted to all three machines. In the case of the two 30 MW sets, they run at 3,000 r.p.m., but the 50 MW set has its pilot exciter driven at 1,000 r.p.m. through gearing.

A major problem arose in connection with the cooling water intakes and outlets. At Cossipore, with the old station having to be maintained in operation, a distance of only

250 ft was available between the inlet and outlet points. Accordingly, the Corporation's consulting engineers made a special study of the matter. Under their instructions a model 1/150 full size of the Hooghly River was set up by Prof. A. H. Gibson at Manchester University, where tidal model experiments were carried out and a satisfactory design evolved. It is believed that this is the first occasion on which model tests were used to measure the temperature rise at the inlet to a circulating water system.

The inlet is combined with the pump-house which contains at present two 26,000 and one 39,000 g.p.m. vertical shaft pumps and the screens and penstocks. The motors driving the smaller pumps are of 485 h.p., that of the larger pump being 725 h.p.

Main Switchgear

As the local h.t. network is 33 kV, the alternators can be connected directly into the system without the need for intermediate transformers. The main switchgear is, therefore, 33 kV single-break, double busbar type with a short circuit-rupturing capacity of 1,500 MVA, manufactured by Metropolitan-Vickers.

In order to limit the effects of fire, the switchgear is divided between two houses coupled by underground cables. The installation at present comprises three generators, one neutral-earthing, two bus couplers, two station transformers and fifteen feeder circuit-breakers. Provision is made for two further generators, one further coupler, and twenty-one further feeder circuit-breakers. These will include feeders to the 6·6 kV substation on the site from which supplies are given to the area near the station. Provision has been made for the installation of reactors to reduce fault currents when the growth of the system makes it necessary.

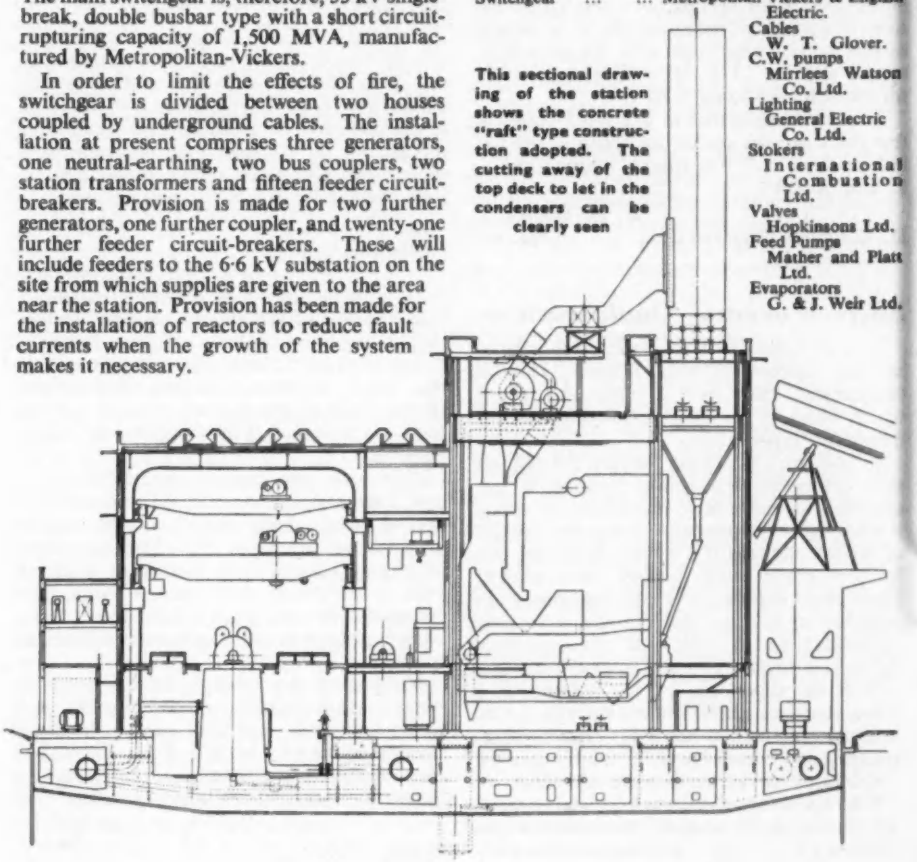
Auxiliary Equipment

The station auxiliaries are supplied on the unit transformer principle whereby power is taken direct from the alternator terminals through a stepdown transformer to the vital auxiliary plant required for that alternator. Thus in the event of a running machine being isolated, and the general system going dead, auxiliary power will still be available.

Alternative supplies are, of course, made available for starting or maintenance purposes.

The 3·3 kV auxiliary switchgear is of the English Electric Co.'s 150 MVA air-break type, and 400 V auxiliary supplies are taken either from English Electric Co.'s 15 MVA air-break gear or through 15 MVA cartridge fuses.

Main Contractors	
Consulting engineers ...	Merz and McLellan.
Civil engineering ...	Hindustan Construction Co.
Buildings and steelwork	Braithwaite Burn and Jessop Constrn. Co.
Boiler plant	Babcock and Wilcox Ltd.
Piping	Aiton and Co. Ltd.
Turbo-alternators ...	C. A. Parsons and Co.
Switchgear	Metropolitan Vickers & English Electric.
Cables	W. T. Glover.
C.W. pumps	Mirrlees Watson Co. Ltd.
Lighting	General Electric Co. Ltd.
Stokers	International Combustion Ltd.
Valves	Hopkinsons Ltd.
Feed Pumps	Mather and Platt Ltd.
Evaporators	G. & J. Weir Ltd.



This sectional drawing of the station shows the concrete "raft" type construction adopted. The cutting away of the top deck to let in the condensers can be clearly seen

OUR READERS' VIEWS

Cooker Wiring

I am very interested in Megohm's comments in your Jan. 26 issue, re 7/·036 for domestic cooker circuits, and disagree with the remark that the extra 10/- or so per house is well worth it.

The opinion which I have held for many years, that 7/·036 is ample for the ordinary house cooker is backed up by very eminent men in Post War Building Studies No. 11, which recommends 7/·036 for cooker *and* 1/·044 for lighting, destroying the fetish that a so called "good" job must be 3/·029.

The negative evidence given by Megohm to the effect that 7/·036 has given no trouble in many cases is not helpful, but a few first hand cases of trouble in cooker circuits being caused by this gauge wiring might alter the opinion of myself and the I.E.E. committee responsible for the aforementioned book.

I might mention that in one job I visited a few years ago the cooker had been in use for five years on a 3/·036 circuit, looped from a 15 amp socket !

D. A. Deeley

D. A. Deeley Electrical Ltd. Director.
Maidenhead.

Shift Workers' Qualifications

I would like to express my whole-hearted agreement with Stanley Thomas (ELECTRICAL TIMES, Feb. 2, 1950) with regard to his views of the educational difficulties of ambitious shift-workers.

In addition I would put forward the opinion that correspondence course training is not accorded the authoritive recognition to which it is entitled. The trend is to deride this method of tuition, and regard it, at best, as second-rate in comparison with evening class tuition. Having had experience of both methods, I am prepared to say that this outlook is unjustly prejudiced, and further, that correspondence tuition is in *advance* of oral evening class tuition.

It is the experience of the writer that a correspondence course student studying for an external examination has a far deeper understanding and knowledge of his subject than the majority of his fellows at night-school.

I do not contend that correspondence training is necessarily without its attendant disadvantages—nor can it ever replace laboratory work—but I do say that these disadvantages are of a lesser degree than those of evening classes.

The grit and determination (excellent character-forming incidentals) necessary to complete a correspondence course, is worthy too of strong admiration.

J. T. Parsons

Fenwick, Ayr.

Rural Electrification

Your correspondent's statement that electricity on the farm should be No. 1 priority, although sound in theory, is hardly borne out in practice, since statistics show that far less than half the farmers on supply use it for farming purposes.

A simple solution to the problem of the "new type of farmer" would be for him to take over the farms already electrified and leave the others to the peasant type, which is shown to be in the majority. It might be more profitable, though, for us to concentrate on electrifying those farms already on supply, rather than to keep flogging the case of the ones without it.

E. C. Cluydar

Eastbourne.

May I say how gratifying it was to read "Meteor's" last note on unofficial secrets etc. A real bit of the good old days. But then to turn over on the next page, and find a bit of the usual depressing modern helplessness (Rural Electrification) and somebody calls it No. 1 priority. Was there ever such nonsense ?

Fifty years ago, before the days of motor cars, I remember a church in London, which desired electric light and put in a gas engine generator set and got it. Since then thousands of sets of various types have been installed even to automatic sets, because those concerned had the guts to go and get them. Even recently, stand-by sets have been offered in quantity.

If therefore, the farmer, who has plenty of money, wants electricity let him have the guts to go and get it. Let him spend a thousand pounds on his own plant and not squeal because the public supply refuses to spend ten to twenty thousand pounds to give it to him.

A. V. Summers

Ealing, W.5.

WATTS VOLTS and *VARS*

The Principles of Power Flow Control for Efficient System Operation

By J. R. MORTLOCK, Ph.D., B.Sc.(Eng.) M.I.E.E., Mem. A.I.E.E.

Part 2

Synchronous Condensers

On extensive systems at times of light load, due to the preponderance of capacitative current, the voltage at locations remote from sources tends to rise and in extreme conditions generator excitation instability may be experienced due to the leading power factor. These conditions can be corrected, at the remote locations, by running synchronous condensers under-excited to compensate for the line capacitative current. Equally at times of maximum load the voltages at the same remote locations may be low. This can be corrected by running, at these locations, synchronous condensers over-excited to reduce the line current or in some instances to give a leading power factor with its associated voltage rise. On interconnected systems vars can also be supplied by varying the generator excitations, but only within limits, as if the var demand is large it may entail reducing the watt output.

If a network analyser is not available the overall performance can be ascertained with the aid of modified Evans and Sels charts which are probably the most useful of the many types devised.* Sending and receiving charts for a 160 miles, 220 kV single line, are shown in Figs. 9, 10. Assume that the sending end voltage is maintained constant at 200 kV and that the receiving end voltage is also to be maintained at this value by a synchronous condenser, automatically controlled. If the load limits are zero to 90 MVA at 0·8 lagging power factor, what is the rating of the synchronous condenser required?

A single line does not ensure a "firm" supply and in general two lines would be used. Consequently the limiting conditions are, no load—two lines in use; maximum load—1 line in use. Considering primarily no load operation, the lines being identical only one need be treated and the results multiplied by two. From Fig. 10, for zero load and $E_S/E_R = 100\%$ the load should be 17·5 MVAR lag and this will have to be provided by the synchronous condenser; for two lines the required MVAR will be 35 lagging.

* A description will be given in a subsequent article.

The corresponding conditions at the sending end can be determined from Fig. 9: without the synchronous condenser the load angle from Fig. 10, is 0·35° and $E_S/E_R = 96{\cdot}3\%$ and with the synchronous condenser 0° and 100%. From Fig. 9 for $E_R/E_S = 104\%$ and 0·35° and for $E_R/E_S = 100\%$ and 0° the sending end loads are 0.9 MW, 34 MVAR and $\longrightarrow$ 0 MW, 17 MVAR respectively. For the loaded conditions from Fig. 10 for $E_S/E_R = 100\%$ and for 72 MW (90 MVA $\times$ 0·8) the MVARs should be 23 leading and as the load provides 54 MVAR lagging the synchronous condenser will have to provide 77 MVAR lead. For simplicity machine losses have been neglected.

In many instances the voltage at the sending end can be varied to suit the loads. Assume that the voltage regulators on the generators are arranged to vary the sending end voltage from 210 kV at no load to 240 kV at full load. With this method of operation at no load $E_S/E_R = 95{\cdot}4\%$ and from Fig. 10 the synchronous condenser rating required is $(4 \times 2) = 8$ MVAR leading compared with 35 MVAR lagging for constant voltage transmission. At full load $E_S/E_R = 109\%$ and proceeding as before the synchronous condenser rating is 10 MVAR lead compared with the previous value of 77 MVAR. The generators should be suitable for working under these conditions, the actual loads being determined as previously from Figs. 9 and 10.

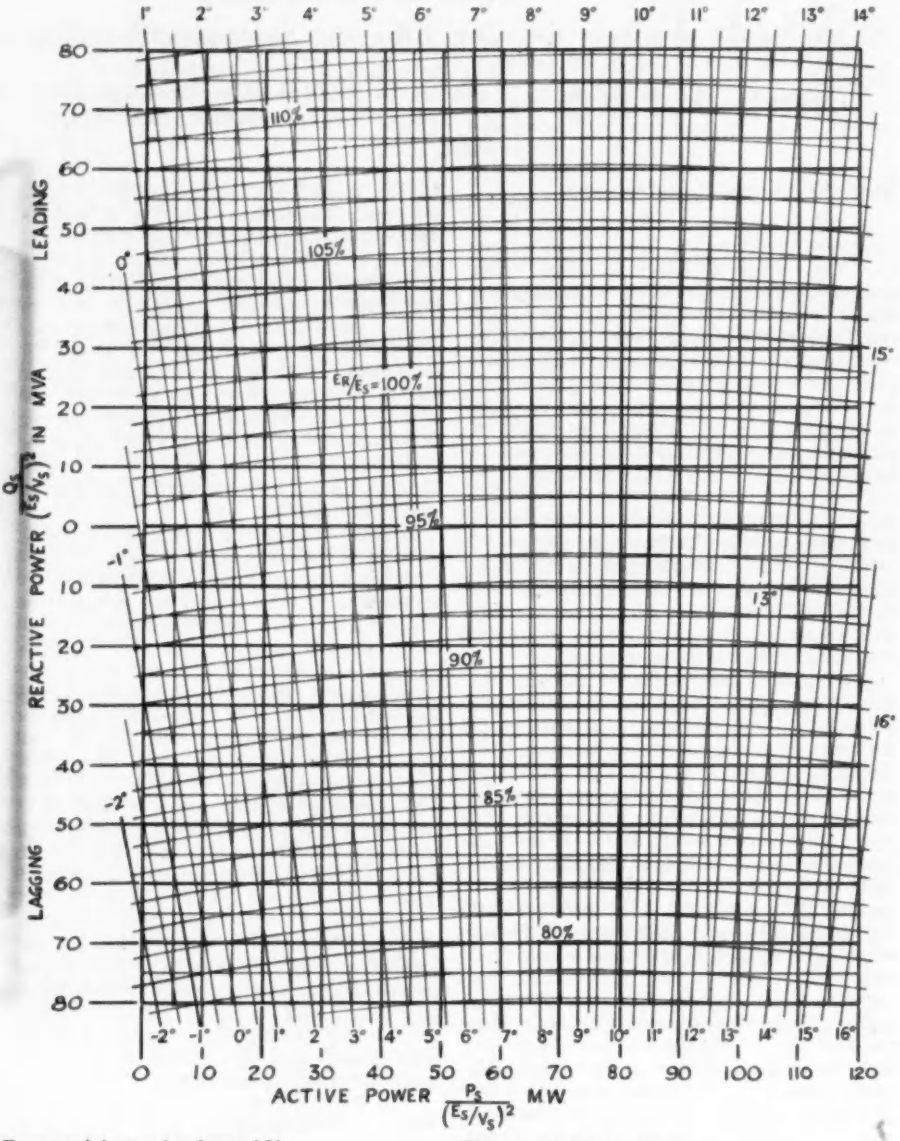
Synchronous condensers are machines designed specifically for supplying a variable amount of vars and consequently in general can do so more economically than generators. If relatively fixed amounts of vars are required static apparatus is usually more economical and consideration should be given to the use of shunt reactors and capacitors.

Shunt Reactors

If synchronous condensers are required to take only lagging MVARs they are in essence rotating reactors and it is cheaper to use static shunt reactors. These have been applied successfully on systems up to 220 kV, banks

Fig. 9. Sending end chart for 220 kV 160 miles

Conductors: A.C.S.R. 54 strands, 0·1384-in. aluminium 7 strands, 0·1384-in. steel, copper equivalent 0·65 in. dia. 25-ft. spacing. *Resistance per mile:* 0·1025 ohms. *Inductive reactance per mile:* 0·6465 ohms. *Shunt capacitive reactance per mile:* 0·2199 megohms.



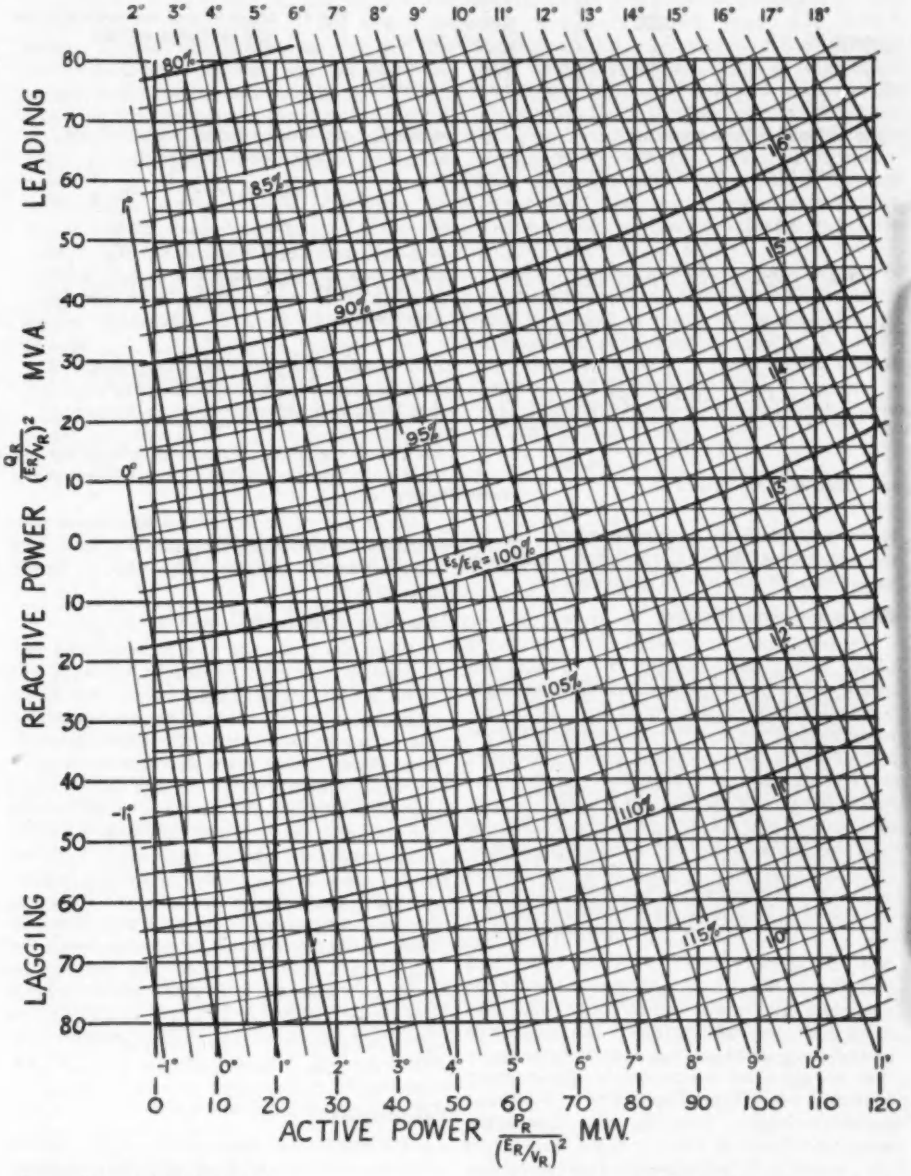
E_R = receiving end voltage, kV
E_S = sending end voltage, kV
V_S = 220 kV
Enter chart with E_R/E_S and angle from Fig. 10 and read scale values of MW, MVAR.

The actual values are:—

P_S (MW scale value) $\times \left(\frac{E_S}{V_S}\right)^2$ MW

Q_S (MVAR scale value) $\times \left(\frac{E_S}{V_S}\right)$ MVAR

Fig. 10. Receiving end chart for 220 kV 160 miles



E_S=sending end voltage, kV

E_R=receiving end voltage, kV

V_R=220 kV

For actual power P_RMW, Q_RMVAR and voltage E_R enter chart with $\frac{P_R}{\left(\frac{E_R}{V_R}\right)^2}$ MW, $\frac{Q_R}{\left(\frac{E_R}{V_R}\right)^2}$ MVAR and determine E_S/E_R and angle.

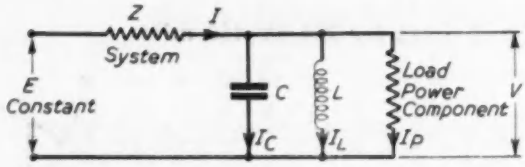


Fig. 11. Effect of load characteristics on the operating voltage

Case 1: Load power constant

$$I_C = jV\omega C \quad I_L \equiv -j\frac{V}{\omega_L} \quad I_P = \frac{P}{V}$$

$$I = \frac{P}{V} + jV\left(\omega C - \frac{1}{\omega_L}\right)$$

$$E = V + IZ = V + \frac{PZ}{V} + jVZ\left(\omega C - \frac{1}{\omega_L}\right)$$

and $$V^2\left(1 + jZ\left(\omega C - \frac{1}{\omega_L}\right)\right) - EV + PZ = 0$$

from which

$$V = \frac{E \pm \sqrt{E^2 - 4PZ\left(1 + jZ\left(\omega C - \frac{1}{\omega_L}\right)\right)}}{2\left(1 + jZ\left(\omega C - \frac{1}{\omega_L}\right)\right)}$$

i.e. there are two values of V

being connected to tertiary windings on the main transformers and the number in use being varied in accordance with requirements.

Shunt Capacitors

The most common application of these is for power factor correction at low voltages but equally they can be used in lieu of synchronous condensers at high voltages and are employed as such fairly generally on the Swedish 110 kV and 70 kV networks. Some care is required in their application to transmission systems as, firstly, when switched in they are equivalent to a short circuit, secondly, the possibility of series resonance with the system series reactance must be considered and, thirdly, if the power is not sensitive to voltage variations then under some exceptional conditions stable operation is possible at two values of voltages, one considerably lower than the other and therefore to be avoided. Although the last is not due essentially to the use of shunt capacitors it has been met with where their use is extensive as switching in a bank can reduce temporarily the voltage and consequently there exists a greater possibility of operation at the lower stable voltage. Consider the equivalent simplified circuit of Fig. 11, if the load power can be considered as independent of the voltage it is evident that there are two voltage values which will satisfy the conditions whereas if the load power varies with voltage, i.e. has resistance characteristics, only one voltage value will satisfy the conditions. Systems subsequent

Case 2: Load power varies with voltage
e.g. resistance load

$$I_C = jV\omega C \quad I_L = -j\frac{1}{\omega_L} \quad I_P = \frac{V}{R}$$

$$I = V\left(\frac{1}{R} + j\left(\omega C - \frac{1}{\omega_L}\right)\right)$$

$$E = V + IZ = V + VZ\left(\frac{1}{R} + j\left(\omega C - \frac{1}{\omega_L}\right)\right)$$

from which

$$V = \frac{E}{1 + Z\left(\frac{1}{R} + j\left(\omega C - \frac{1}{\omega_L}\right)\right)}$$

i.e. V is single valued

to a fault (or its equivalent) have been known, under the former condition, to stabilise at the lower voltage.

If, in lieu of capacitors, synchronous condensers with voltage regulators are used they will restore the voltage to the value set by the regulator.

Series Capacitors

When the reactance of a feeder circuit sets a limit to operation it can be balanced out partially by series capacitance. The major difficulty is the limitation of the voltage across the capacitor bank under short circuit conditions as the voltage across the capacitor is equal to $I/\omega C$ and therefore if the short circuit current is 20 times the normal or load current the voltage across the capacitor bank will be 20 times normal. In practice a gap, set to flashover at 3-4 times the rated normal voltage, is connected in parallel with the bank and a breaker is connected in parallel with the gap; normally open, the breaker is tripped to close when the gap flashes over and when the current has fallen to a relatively low value it opens reinserting the capacitor. A 220 kV installation has been commissioned recently in Sweden and consideration has been given to a 380 kV application.

General

The methods of controlling the distribution of watts and vars and the magnitude of voltages have been reviewed but before any of them are adopted it is essential that the operating conditions should be analysed adequately. For example their effects when the particular system is lightly and fully loaded with and

without at least one major link in commission must be known. System load grows at approximately 7 to 8% per year and consequently their effects on the system, as forecast, 5 years ahead should be considered. The effects of sudden system rearrangements due to the isolation of faulty sections and the effects of sudden load changes must also be considered. Dead band effects may be troublesome and on occasion it may be preferable to operate some of the generators on manual control of excitation.

Operation schedules should be designed to give minimum losses while retaining the desired values of voltage at important locations and the desired VAR loadings on generators. The methods of control must be adequate to ensure this under all likely operating conditions.

It will be appreciated that the scope of such analyses is wide and is beyond the capabilities of d.c. resistance type boards. In the U.S.A. there are about 20 a.c. network analysers owned by Supply Companies, Universities, Government Authorities and Manufacturing Organisations and for approximately 60% of their available time they are engaged on load flow analyses. Apart from d.c. boards facilities in this country up to a few years ago were limited to one a.c. analyser installed at Newcastle but in 1947 a second analyser was made available in London and recently a third has been commissioned at Stafford; others are projected. Incidentally, a valuable feature of these analysers is the development, in their application, of a "system sense" as it is possible to assess the results of any mal-operation without experiencing them.

More generally, it is essential that systems be designed for efficient operation and to accomplish this end there must be proper appreciation, during development, of the means of control and their application. There casual use as measures of expediency after troubles or difficulties have arisen cannot be counted upon to give the best results.

DUCT MOULDING *IN SITU*

Inflatable Rubber Cores Now Commercially Available

OF immense value to the contractor, "Ductube" an inflatable rubber tube used for fabricating ducts in concrete, is now freely available to the building and allied trades.

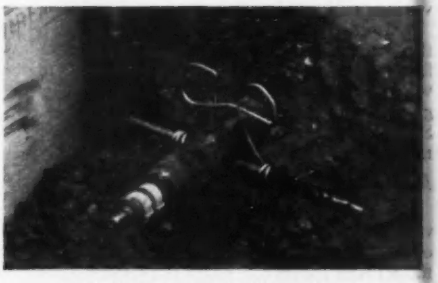
It is essentially a tough rubber tubing which will withstand great pressure when inflated and by reason of its unique construction, when deflated, it will free itself from the material in which it has formed a duct.

We were privileged to witness some rigorous tests carried out on "Ductube" at the Fulham works of Messrs. Wiggins-Sankey Ltd. who have been appointed sole agents for the material throughout the British Isles including the Irish Republic.

The tubing is inflated to the size required by means of a normal Schrader tyre valve (50 lbs.-70 lbs. per sq. in.) laid in the mould and the concrete poured. When the concrete has set, the tube is deflated; as it does so it extends in length approx. 15% and twists laterally thus freeing itself. The tube can then be withdrawn for re-use.

The basis of the Ductube patent is the diagonally braided fabric core of the tube. One set of the diagonal threads in this fabric core has been braided with greater tension thus causing a twisting movement along the tube.

"Ductubes" are supplied in lengths of 60 ft.



The inflated "Ductube" in position

and in four diameters to produce ducts of 1 in., 1½ in., 2 and 3 in. diameter. They can be joined by using normal end fittings and "bulldog" pattern straps and by reason of their construction can form curved ducts with radii as small as 18 in. in the case of the 3-in. tubes.

Being made of high quality rubber the Ductubes will resist the harsh treatment inevitably met with in concrete working. They have been used successfully in other countries for many hundreds of mouldings and yet, with the usual elementary precautions, still remain serviceable.

MANUFACTURING PROGRESS IN 1949

No. 8—Bruce Peebles and Co. Ltd.

AN increased output from all departments, with a high proportion for export, is reported from Bruce Peebles, and record shipments were made. At the close of the year better delivery dates were being quoted for most products than seemed possible a year ago.

Rotating Electrical Plant

Of more than ordinary interest are several complete hydro-electric plants in units up to 21 MW for the Scottish Highlands. Work is also proceeding on numbers of units in sizes up to 11·2 MW for various water-power projects in Norway; and on two 10 MW generators, and 15 MVA, and 10 MVA synchronous condensers for hydro-electric schemes in New Zealand.

Contracts in hand for converting plant include nineteen 2,500 kW, 1,500 V rectifier equipments for railway electrification, two 1,000 kW glass bulb rectifiers for Edinburgh Transport Dept., 2,500 kW and 1,500 kW motor converters for India, and three 1,500 kW motor generators for Australia.

The past year has seen the completion of the first of two 12 MW vertical generators for the Loch Fannich scheme of the North of Scotland Hydro-Electric Board. Shipments overseas of hydro-electric plant included a 3,000 kW slow speed unit for Colombia, South America; and 2,100 kW, 1,600 kW, and 1,040 kW units for various schemes in Norway.

Other types of generators dispatched from the works included three 1,750 kW geared sets for coupling to steam turbines for a fertilizer works in England; and 5,000 kW of engine type generators for service in isolated areas in Scotland where hydro-electric power cannot be made available.

Motors

Orders received for electric motors cover virtually every industry, and the mechanisation of the mines resulted in important demands for flameproof motors. Work in progress includes 17,100 h.p. of slow speed synchronous induction motors of 1,900 h.p. each; four for South Africa, three for Australia, and two for Portugal; 7,500 h.p. of large diameter slow speed induction motors in sizes up to 1,200 h.p. are being made for irrigation and sewage schemes in Australia, and impressive numbers of flameproof motors are destined for mines in South Africa and Poland and oil installations.

The growing trend in power station practice towards the use of very large squirrel cage motors for direct starting is exemplified by a 2,050 h.p. 3,000 r.p.m. motor completed during the year, for driving a boiler feed pump at the Portobello power station of the B.E.A. Special features in the construction of the motor include a stream-lined, surface cooled, rotor with "keyed" conductors—a method of construction which positively secures the rotor bars in the slots and prevents vibration of the windings during the starting cycle and at the same time ensures secure axial anchorage of the complete "cage."

Transformers

Orders for transformers from a few kVA up to the largest sizes for voltages up to 132 kV have set up new records, and the volume of work in hand or completed in 1949 may be judged by the impressive total of 1,500,000 kVA. The demands in this country alone are heavy, but a significant fact at the present time is the sustained demand from overseas.

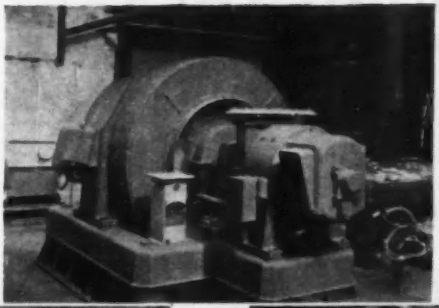
One of the outstanding features in a year of continuous progress was the completion of the first of two 75,000 kVA generator transformers for the new extensions now proceeding at Portobello. These transformers are the largest ever built in Scotland.

Duplicate 100% forced oil cooling is employed. The oil is pumped through a nest of small bore tubes housed in a jacket through which the cooling water flows and carries the heat away to waste. The motors driving the pumps receive their supply through an auxiliary transformer arranged to switch in simultaneously with the main transformer.

Among other large transformers completed during the year emphasis is placed on a 60 MVA three-phase bank of 132 kV single-phase water-cooled units for the Clunie power station (Tummel-Garry project) and two 20 MVA three-phase units for the Loch Fannich scheme of the North of Scotland Hydro-Electric Board; 30 MVA, and 15 MVA three-phase units are on order, along with large numbers of distribution transformers for various areas of the B.E.A.

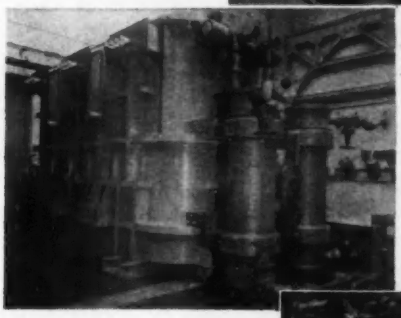
Of special interest are four three-phase oil-immersed magnetically-shielded reactors completed for the Portobello power station of the B.E.A. Each is capable of dealing with a power fault of nearly 500 MVA, and they are believed to be the largest oil-immersed units of their type ever to be built in this country.

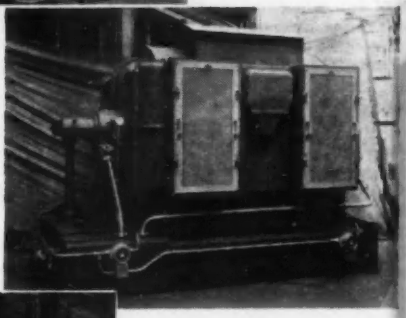
Overseas transformer shipments included four 5,400 kVA units for Canada; four 4,575 kVA rectifier transformers for South African Railways; two 5,000 kVA units for Sweden; and two 1,200 kVA units for Uganda. Impressive shipments of the Company's standard distribution transformers were made to all parts of the world.



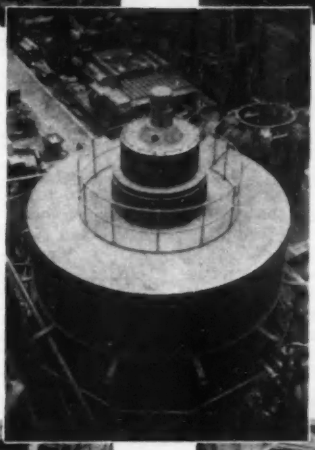
Below : 75,000 kVA generator transformer for Portobello power station, showing the oil coolers

On left : 950 BHP synchronous motor showing transformer for giving a supply to internal heaters. For the Dutch East Indies





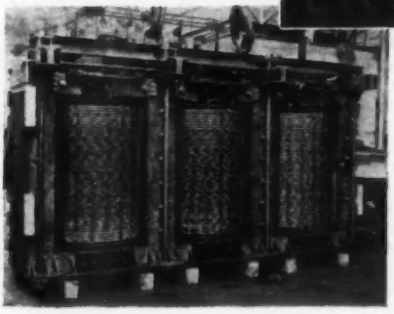
On right : 12,000 kW vertical generator for the Loch Fannich hydro-electric scheme of the North of Scotland Hydro-Electric Board

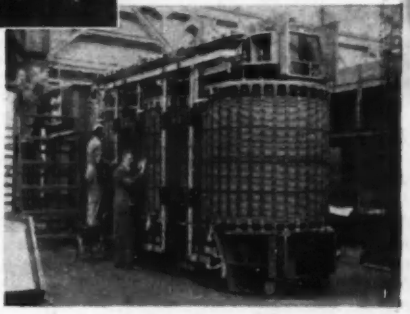


Above : 2,050 BHP 3,000 r.p.m. squirrel cage induction motor for driving a boiler feed pump

Below : Three-phase 33,000 V oil-immersed magnetically shielded reactor, designed to deal with a fault of approximately 500 MVA, for Portobello power station

Below: Completed 75,000 kVA generator transformer for the Portobello power station of the B.E.A.





REWIRING THE COMMONS

Some Musings on the Electrical Installation

IT was with considerable interest that I read in last week's ELECTRICAL TIMES the comprehensive description of the electrical installation for the rebuilt House of Commons chamber, in the Palace of Westminster. As stated in the article, the highest possible quality is the keynote in the whole scheme; but with all due respect to those eminent gentlemen in charge of the work, I would venture to say that "possible" is the operative word, and one may be permitted to wonder what the final results might have been, if nothing whatsoever were impossible. Unfortunately that is not the position today.

To avoid any misunderstanding, let me make it plain that no criticism whatsoever is intended, nor is any doubt entertained about the ultimate results being satisfactory in every way. As a complete outsider, having no responsibility in the matter, I occupy the position of an interested spectator who can commiserate with others in their troubles, having had a fair share of them himself.

Planning

Very few people realise the enormous amount of preliminary work which is necessary before a scheme of this magnitude can be launched and actual work can commence. The architect must design his building to suit the site, the building must satisfy the occupational and aesthetic requirements, and the final costs must be within a certain figure. This means a year or two of hard work, with constant consultations with those responsible for the engineering services, who in their turn must constantly revise their preconceived ideas, to line up with the latest requirements, trying at the same time to incorporate the latest technical improvements and to visualise the supply position at some future, but uncertain, date. Meantime the sponsors of the scheme are constantly pressing for an exact completion date, and probably viewing with undisguised alarm the enhanced costs now estimated for the job.

Tendering

To produce a specification, complete with drawings and the associated tender documents for a scheme of this magnitude—which leaves no doubt as to what is required and is fair both to the client and to the tenderer—is no mean task. It is perhaps even more difficult for those building up all the individual items of which the tender is composed, to estimate accurately the time that may be saved or lost by choosing alternative methods.

Obviously some form of cost-variation clause must be incorporated for any contract of this size, as it is quite impossible to foresee with any degree of accuracy the trend of prices, even for the ordinary components which form the major items of the installation. In theory it might perhaps be simplest to work on a plain time and material, plus profit basis, or to carry out the work with direct labour. In practice with either of these two methods so much depends upon the human element, and the consultant is almost forced to adopt some other form of contract, so as to have some more definite yardstick with which to measure the work, and some form of assurance that the final cost will not exceed some definite figure.

Ductwork

I am not aware if the work in question departs in any way from the current edition of the I.E.E. Regulations, as possibly it might do, as these as yet are not compulsory, though usually followed for all first-class work. Long and complicated conduit runs with special made up drawboxes follow more or less conventional lines, and with this system it is of course an easy matter to alter the circuiting or rewire at any time should this be necessary. Much of this is run in ducts and, contrary to many sad experiences in the past, it is hoped that it has been found possible to allocate separate ducts for the electrical services—not block them up with heating and other services, as is so frequently done.

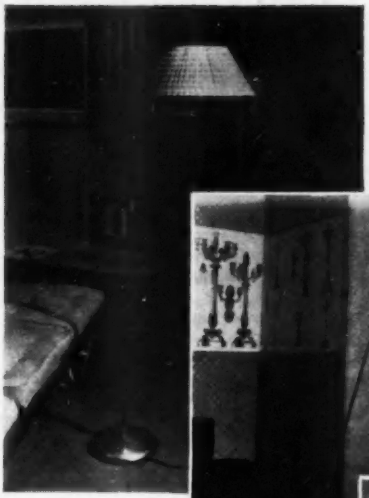
One of the chief drawbacks to this arrangement, apart from the loss of working space, is the high temperatures often encountered, which lessen cable life and may cause condensation elsewhere.

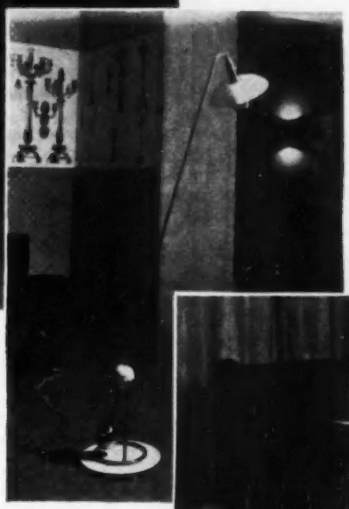
It would have been an interesting experiment, to anticipate what may well be the practice at some remote future date, to install special multicore p.i.l.c. cables, or even "Pyrotenax" cables, with special terminal strips at convenient parts of the run, instead of the many separate wires. This would follow normal telephone practice, and give a considerable scope for variations in circuiting.

The life would be infinitely increased provided there were no defect in the actual manufacturing process, or in the materials employed in their construction. I hope to test out this theory sometime, should a suitable occasion present itself.

Continental Character

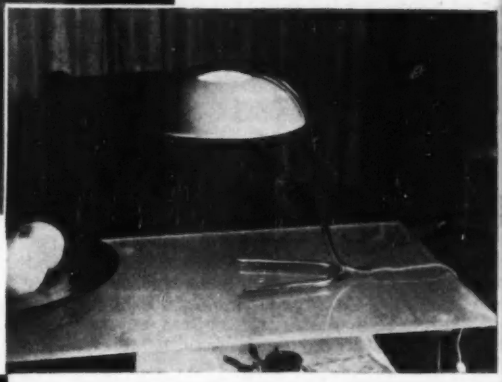
A selection of exhibits from an exhibition of European lighting fittings presented by the Scottish Committee of the Council of Industrial Design, and open in Glasgow from Jan. 25 until Feb. 14



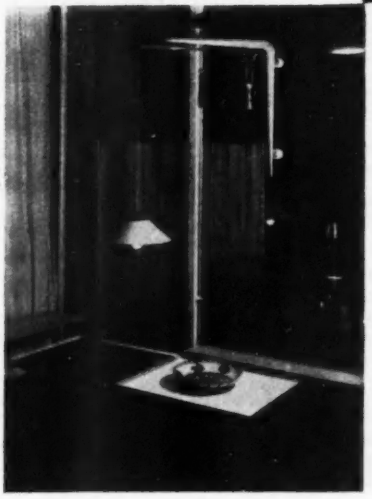


Left: Brass standard lamp from Italy which is weighted with a brass ball at the end and pivots on a second ball approximately one foot from the end. The shade swivels independently

Above: A Swedish standard lamp in brass with coloured fabric shade

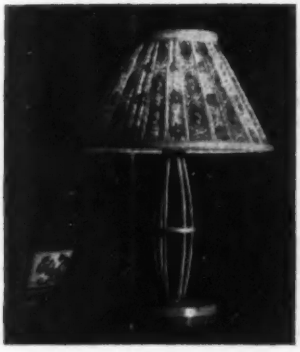


Below: This Italian wall fitting is finished like a crane in polished walnut and brass. An upright arm is hinged to two walnut discs set in a brass rod at the end of which hangs the shade. This is moved by a brass counterweight



Above: Denmark produced this table standard in brass fitted with a white enamelled metal shade. There is a round glass inset on the top of the shade

Right: From Denmark again comes this attractive table standard in wood. It is fitted with a patterned fabric shade, which was made in Sweden and is closed at the top



The E.C.A. Annual Dinner

LORD MANCROFT was the principal guest at the annual dinner of the Electrical Contractors' Association, which was held on Tuesday of last week under the chairmanship of Mr. S. Dickinson, the E.C.A. President, and attended by more than 500 members and friends.

Proposing the toast of "The Allied Associations and Honorary Officials," Lord Mancroft deplored the Government's policy of exhorting private enterprise to produce and export more while at the same time it heaped abuse upon it. There was no crime in making a profit, which was vastly different from profiteering—as instanced by the Post Office which made a very large profit for a reduced standard of service to the public. Private enterprise must not, however, be too self-righteous, there was a danger that in defending it one might overlook its shortcomings. On the subject of exports, he defended British industry against charges of high prices, poor quality, bad packaging and inadequate salesmanship. The reason underlying American criticism was that our exports were rapidly becoming too good.

Mr. Dickinson, replying to the toast, said that the doctrine of "no room for politics in a business community" was outmoded, and it was impossible to avoid politics in business, in controls, and in industrial relationships, and too many decisions were made with an eye on the political situation rather than sound commercial principles. If we could rid industry of party politics we could solve some of our national problems.

The nationalised supply industry had been a formidable opponent to take on in the field of contracting and retailing, but they themselves were not without their resources. They were prepared to meet fair and unsubsidised competition, and they valued every step forward in the direction of mutual goodwill, fair trading relations and maximum service to users. In the end, the public itself would determine the survival of individual enterprise, and they were confident of its verdict.

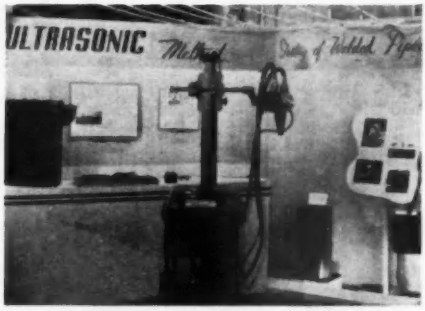
"The Guests" was proposed by Mr. P. G. Wallis, and response made by Mr. A. W. Kenyon (Vice-President, R.I.B.A.) and Mr. W. H. Williams (Chairman, E.L.M.A.), Mr. J. R. Halliwell proposed the toast of "The Chairman."

Support Needed for Welding Research

EFFECTIVE both in increasing productivity and cutting down costs, welding is of importance to a large number of firms, the majority of them relatively small. It is to attract the attention of the managements of such firms that the British Welding Research Association is holding an exhibition on the theme "Research and Production," to illustrate the value of co-operative research to industry in general. The exhibition will be open until Saturday at the Association's Headquarters, 29 Park Crescent, London W.1, and will reopen at the Engineering Centre, 351 Sauchiehall Street, Glasgow on February 20, continuing there until February 24. It will be open each evening.

The London exhibition was opened on Tuesday by Sir Ben Lockspeiser, the secretary of D.S.I.R., who spoke of the Department as regarding the Association as a "favoured child"—a grant of £1 for every £1 of members' subscription was paid to B.W.R.A. from Government funds. At present the Association's income was only £57,000 per year, and this was too small for the work that needed to be carried out. If the amount of money available were greater, the proportionate return for that money in economies in production would be greater still. At least £100,000 were required next year.

The stands of the exhibition have been designed and arranged by the staff of the Association, and include many interesting examples of research technique. In the resistance welding section, for example, is shown a spot welding machine and an ignition



One stand in the welding exhibition

control panel, and these are in operation to demonstrate instruments which have been developed by the Association for measuring the machine variables in resistance welding. Other stands illustrate work on welded structures, on welded pressure vessels and pipe lines, investigations into the cracking of welds in steel and the welding of magnesium and its alloys. Finally, there are sections on welding techniques in repair work and on the non-destructive testing of welded products.

PROBLEMS and PRACTICE

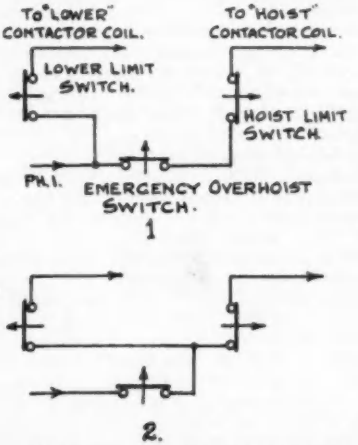
In Engineering

A Fuse and the Weather

A STRANGE fault that occurred at a friend's home recently was that when it was raining and the light in a verandah was switched on the fuse would blow. The strange part was that it only blew when raining. The light was wired in v.i.r. cables on cleats, and on testing the circuit a good "Megger" reading was obtained between conductors and to earth. This reading was taken in dry weather and the light was working perfectly. Some day later when it was raining, watch was kept on the light and some minutes later after the light was switched on the fuse blew. After it had been repaired and replaced I noticed that the roof was leaking and the rain was dropping right across a cleat, and some minutes later the fuses blew again. On investigating the wiring at the point the roof was leaking, it was found the wiring on both conductors had bared and the leak in the roof had allowed the rain to drop across the wires and, as the water was dirty, a short circuit was made. The wiring and roof have been repaired and no further trouble has been experienced.—*C. B.*

Wrong Connections

THE following account of the consequences of a wrong connection is of interest. In 1936 two electrically operated locomotive coaling plants, each of 90 ton capacity, were



Contactor switch connections for coaling plant

installed at an important point by the G.I.P. Railway in India. After being in commission a few days the cradle and a skip jammed at the end of its travel near the bunker mouth of the "down" plant due to incorrect adjustment of the ropes. On inspection it was found that both the hoist limit switch and the emergency overhoist switch had tripped, but owing to an incorrect connection this did not prevent the automatic feature of the starter gear for reversing the motor from operating. On this occasion, with the cradle jammed, the switch merely unwound both ropes to their full extent into the cab until the motor was stopped by the "lower" limit switch opening, the "hoist" and "lower" limit switches being operated by a drive off the winch shaft with a suitable reduction. On check it was apparent that the limit switches had been wired up in accordance with the maker's diagram. In making the diagram it had apparently been overlooked that it was necessary for the limit switches to both be in series with the emergency overhoist switch instead of only the "hoist" limit switch. The diagrams will make this clear. The limit switches were reconnected as shown in Fig. 2, and no further trouble was experienced.—*W. H. G.*

Clip-on Ammeter can Save Time

THE usefulness of the clip-on type of ammeter has been proved time and time again, and I had recent cause to realise its value while carrying out tests on a 70 h.p. motor on the test bed. The motor in question, a three-phase induction motor, was on a full-load temperature run, and the ammeters and wattmeters were fed from current transformers. While it was noted that the speed of the motors was on the high side, this was judged to be due to the fact that the supply frequency was varying and that the speed had been measured while the supply frequency was a little above normal; all other conditions appeared to be as anticipated. However, after two hours had elapsed, there was no appreciable rise in temperature of the motor frame, and as it should then have been nearing its final temperature, it was thought that things were too good to be true. This proved to be the case, for a clip-on ammeter on one of the cables showed that the motor was on half full load, not on full load, this error being due to a misunderstanding with regard to the ratio of the instrument transformers connected to the meters. The direct reading of current given by the clip-on ammeter, although not of the degree of accuracy given by the other instruments, revealed what might have been detected earlier if it had been used as a check at the beginning of the test.—*M. B. C.*

Contributions to this feature dealing with specific problems and items of interest to practical engineers are welcome, and will be paid for at our standard rates.

OVERSEAS NEWS

Swedish Scheme

Claimed to be the first of its kind in the world, a 220 kV series condenser is being installed on the 300-mile Stadforsen-Hallsberg line at Alfta, North Sweden, by the Swedish Power Board, in conjunction with Asea, Sievert and Liljeholmen Cable Works. Consisting of 396 30 kVA units in each phase, the capacitors are installed in a steel structure supported by suspension insulators, the structure being designed for a total capacitor weight of 160 tons. Protection is provided by a spark gap arranged to break down at 2·8 times the rated voltage of the capacitors, and close a by-pass circuit breaker. A close study has also been made of the possibilities of utilising series capacitors on the 380 kV system, and calculations show that the transmitting capacity of a line can be increased some 30%, from 375 to 495 MW, with a reduction in transmission cost per kW year of approximately 20%.

Explaining Sydney's Troubles

In an effort to combat recent criticism, and remarks alleging dilatoryness, Mr. G. S. Boyd, general manager of the Sydney County Council electricity undertaking, contributed an article in a recent issue of the *Sydney Herald*. In this he set out the difficulties encountered by the Council in its effort to increase generating capacity, first, during the early part of the war when British firms were banned from tendering for such plant, and more recently by the long delay between placing an order and delivery of the plant. Thus, for the Pyrmont "B" station, which was originally planned to be in service in 1946, the first 50 MW turbo-alternator should be in commission early next year. When completed in 1954 this station will have a rated output of 200 MW. The last of the sets for Bunnerong should be in service in 1952, bringing the capacity of that station to 375 MW. Land is also being acquired at Lugarno, about 15 miles from Sydney, for the construction of a 300 MW station, but the first 50 MW set here was not planned for operation before 1955.

Australian Production

The steady advance of the Australian electrical machinery and equipment manufacturers, is reflected in the annual bulletin of the Commonwealth Bureau of Census and Statistics, covering the year 1947-48. Brief details of this report were given in our January 5 issue, but we are now able to publish further data. The bulletin records that in the year 1938-39 there were 360 local factories, employing 10,666 persons, producing electrical machinery and equipment. Their combined output in that year was valued at £6,954,000. In 1947-48 there were 732 such factories employing 27,579 persons, the output of goods being valued at £27,891,000. Our two tables list the numbers and value of the various items produced in Australia during the year 1947-48. It is also of interest to note that during the same period, exports

PRODUCTION IN 1947-48

	No.	Value £A.
Dynamos	203	69,236
Generators	4,130	144,741
Motors, f.h.p.	97,871	832,700
,, 1 h.p. and above ...	42,503	913,348
Transformers, above 20 kVA	1,701	501,239
,, below 20 kVA	345,909	549,601
Meters	219,966	669,624
Portable tools and appliances	—	344,807
Starters and controllers ...	—	2,022,065
Accumulators	841,283	1,517,767
Dry cells	28,700,000	1,175,200
Household fittings (switches, etc.)	—	742,014

DOMESTIC APPLIANCES PRODUCED IN 1947-48

	Number	Value £A.
Clocks	22,168	57,742
Fans	59,564	323,726
Irons	253,065	332,254
Jugs	64,045	64,151
Fires and radiators	83,392	163,538
Toasters	149,973	190,199
Washing machines	15,217	536,501
Vacuum cleaners	85,779	840,460
Domestic cookers	98,584	1,266,512
Refrigerators	53,332	3,564,472

of batteries and accumulators amounted to £A.189,388, of cable and wire £A.194,544, of lamps £A.40,006, of motors and generators £A.109,031, and of other electrical machinery and appliances, £A.319,365.

Nearing Saturation Point

Tasmania claims to assist rural users of electricity to a greater extent than any other country in the world, according to the report of the Hydro-Electric Commission for the year ended June 30 last, just received. Up to that date, extensions to provide supplies to 6,207 consumers had been approved by the governor-in-council; of these, 3,186 (51%) had been connected, the State contribution toward the capital cost being £146,543. The State's average contribution to such costs, however, amounted to £61 6s. per consumer! It is estimated that nearly 90% of homes in Tasmania have electric service. During the year under review a further 7,001 cookers and 3,086 water heaters were connected. The Commission made a net profit of £4,198 over the year. Substantial progress has been made with the construction of the Nive power development, and orders have already been placed with Boving and Co. Ltd. for four 35,000 h.p. water

turbines, with the General Electric Co. for the associated 31,250 kVA alternators, and with the Brush Electrical Engineering Co. for four 30 MVA banks of transformers. The first of this plant is due for delivery in 1952.

B.C. New Project

The third major hydro-electric project to be launched by the provincially owned British Columbia Power Commission since 1945 has been approved by the Premier. The scheme—to serve the Sechelt area—provides for the construction of a hydro-electric plant at Clowhom Falls with a capacity of 20,000 h.p.

Scope in Canada

From his recent visit to Canada, Sir Cecil Weir, chairman of the Dollar Exports Board, has returned to England with the intention, among other things, of ensuring that British concerns tender for contracts for the Toronto subway construction and rolling stock. He feels sure that in price and specification the British engineering firms can compete successfully on this type of project. It is estimated that the rolling stock side of the scheme alone will amount to about $5 millions.

Ontario-Manitoba Joint Plan

It has been announced that the two Provinces, Manitoba and Ontario, are to work together to develop the Winnipeg and English River watershed to their mutual advantage. The negotiations, which were initiated almost two years ago, were culminated last month, in their initial phase at least, with the setting up of a tribunal to be known as the Winnipeg River Interprovincial Engineering Board, which will report jointly to the two governments concerned. The development scheme so far proposed envisages four new Ontario power generation sites with a total of 245,000 h.p., to which Manitoba would presumably have access. The announcement of the formation of the Interprovincial Board has met with approval in Manitoba, where it had been earlier estimated that there would be a power shortage about 1953 or 1954. It is now considered that the Winnipeg River, if properly utilised, could produce enough power to meet the main needs of the province until about 1963. If, in addition, Manitoba would buy power from Ontario, generated at the proposed new 150,000 h.p. plant at Boundary Falls, and elsewhere, the province's need to develop the difficult and expensive power sites in the northern part of the province could be postponed till about 1970.

Winnipeg Extension

In an effort to forestall possible serious power shortages in Winnipeg, the city Public Utilities Committee has ratified power extensions by the purchase of a 15,000 kW steam turbo-alternator for the Amy Street plant, at a cost of $458,461. Present capacity of this station is 10,000 kW. The new generating set is planned for installation by the end of 1951.

India's N.P.L.

The National Physical Laboratory of India was formally opened at New Delhi a few days ago by the Deputy Prime Minister. The Laboratory will have the first electron microscope to be set up in India, and research is to be undertaken on radar, meteorology, a study of the planetary system and cosmic rays. There will be ten divisions in the laboratory: weights and measures; applied mechanics and materials; heat and power; optics; electricity; electronics and sound; building and housing research; hydraulics, and analytical chemistry and industrial research. The director of the laboratory is Dr. K. S. Krishnan, F.R.S. Work was begun in the laboratory before its formal opening and it has already made a significant contribution on the manufacture of carbon electrodes, properties of ultrasonic vibrations and the behaviour of plastic materials, it is reported.

Report on H.E. Works

Commendation of the various hydro-electric projects in New Zealand is given in the report of Dr. J. L. Savage, the American consulting engineer, in his report just published. He is of the opinion that New Zealand will require many more such projects and need them as fast as they can be constructed. If the Government was to construct its hydro-electric works quickly and economically, it would have to increase considerably the designing staff of the Commissioner of Works and consider the use of plant with a large capacity. In his view probably the most satisfactory arrangement would be a system whereby contracts would be arranged with combinations including one or more local contracting firms and one or more foreign contracting firms on the basis of completion periods that would involve rapid construction by means of large capacity plant. He thought that the general layout of the Roxburgh Gorge hydro-electric project embodied a well-considered and conventional general design, and the Ministry of Works had been warranted in adopting and starting the construction. An underground power station could be constructed at Huka Falls, whilst preserving the scenic and fishing attractions.

Gold Coast Schemes

Brief details were given in Accra last week-end by representatives of Sir William Halcrow and Partners, of the survey which has been made of the water power resources of the River Volta. The proposals being examined include the construction of a dam at Ajena, about 65 miles from Accra, and a 800 MW hydro-electric scheme, to provide power for aluminium production, thereby replacing existing power stations in the Gold Coast Colony and the neighbouring Ashanti Province. Another plan provides for a dam at Biri on the Black Volta in Northern Territories of the Gold Coast, and a hydro-electric scheme.

PERSONALITIES

In the Industry

Among the first of the Admiralty civilian engineering officers to volunteer for transfer to the Royal Navy, **Mr. L. Bomford,** B.SC., A.M.I.E.E., has now been commissioned in the rank of Commander (L.) R.N. and joined H.M.S. *Collingwood* a few days ago. Commander Bomford served a college apprenticeship with the Lancashire Dynamo and Crypto Ltd., and served them in America and Canada. In 1936 he joined the Electrical Engineering Department of the Admiralty, and during the early part of the last war was engaged on problems in dealing with magnetic and acoustic mines. In January, 1942, he was appointed warship electrical superintendent, Northern Ireland. Two years later he was selected for special duties in the temporary rank of Capt. (L.) in the Pacific and in Australia. Returning to this country in 1946 he became Admiralty Regional electrical engineer, operating in the North Midlands, North Eastern and N. Western England, Scotland and Northern Ireland. Since 1948 he has been superintendent electrical engineer, Northern Group.

Mr. V. M. Roberts, B.SC., A.M.I.E.E., has been elected chairman of the Radio Communication and Electronic Engineering Association in succession to **Mr. F. Stanley Mockford.** The new vice-chairman is **Mr. K. S. Davies,** B.SC., A.M.I.E.E., general manager of the Electronic Division of Murphy Radio Ltd. Mr. Roberts is manager of the Electronic and Sound Sales Department of the British Thomson-Houston Co., and a director of Multi-Broadcast (Engineering) Ltd.

West Midlands area representative of Berry's Electric, Ltd., for the past year, **Mr. F. Duckham** has now been nominated Midland branch manager of the company. Prior to the war he was engaged in the electrical wholesaling industry in the North Midlands area, after serving his apprenticeship. He is succeeded as West Midlands representative by **Mr. L. B. Powell,** who joined Berry's in May, 1947. Mr. Powell served a short works apprenticeship with G. Ellison, Ltd., afterwards joining the consumer's section of the Sutton Coldfield Electricity Department. Later he became junior development engineer in the design department of Chamberlain and Hookham.

Mr. F. Duckham

Mr. L. B. Powell

Mr. J. Halliday, an electric locomotive driver at Kearsley generating station, won the lightweight weight-lifting title at the Empire Games in New Zealand this week, with a total of 760 lb, setting up a new Empire record. His snatch of 245 lb and jerk of 310 lb also beat previous British Empire records.

Last week saw the retirement of **Mr. A. J. Bailey,** works manager to Cooke and Ferguson Ltd., with whom he had served for the past 22 years. He served his apprenticeship with the old Westinghouse Co., at Trafford Park, and later spent four years with B. and S. Massey. In 1924 he joined the Igranic Electric Co. Ltd., as assistant works manager, but returned to Manchester in 1928 to Ferguson Pailin Ltd. Within three months he was promoted to works manager, holding that position till 1941, when he transferred to the Metropolitan-Vickers Electrical Co. Mr. Bailey joined Cooke and Ferguson after the war, and was responsible for the laying out of their modern production unit. At a dinner in his honour he was presented with a television set by Mr. Sam Ferguson, subscribed for by his colleagues.

Mr. A. J. Bailey

Adding to their golfing trophies, **Mr. D. Sullivan,** general sales manager of De La Rue Extrusions Ltd., and De La Rue Floors and Furnishings Ltd., and **Mr. J. S. A. Bunting,** M.C., a director of Edison Swan Electric Co., won the Men's Foursome Cup, at the Wildernesse Country Club, Sevenoaks, Kent, recently. Subsequently Mr. Sullivan beat **Mr. C. D. Phillipe,** of Bakelite Ltd., to reach the London semi-finals in the "Beetle" Trophy competition of the Plastics Industry Golfing Society. The other London semi-finalists in the latter competition are **Mr. F. A. Garrett** of Rootes Mouldings Ltd., **Mr. T. H. Wood,** late of United Glass Bottle Manufacturers Ltd., and **Mr. P. Smith** of Bakelite Ltd.

In succession to Mr. D. Holt, who is now manager of the Central Gloucestershire sub-area, the Midlands Electricity Board has nominated **Mr. W. F. Russell**, A.(Amer.)I.E.E. as manager of the Wolverhampton district. He took up duties this month. Mr. Russell was previously manager of the Lichfield district of the Board, having been chief electrical engineer of the Corporation undertaking since its inauguration in 1926. Since that date, he has been responsible for the extension of supplies to every parish in the area; 85% of possible connections were made.

Mr. W. F. Russell

Prof. P. M. S. Blackett has been appointed a pro-vice-chancellor of Manchester University.

Following the recent signing of an agreement between the Government of India and Standard Telephones and Cables, Ltd., wherein the latter act as technical advisers for the establishment of a factory in India for the manufacture of communication cables (see ELECTRICAL TIMES, Dec. 8) S.T.C. announce the appointment of **Mr. L. E. Anderson**, A.M.I.Mech.E., as cable consultant (India). He has been associated with the company and its predecessor, the Western Electric Co., since 1919, and for the past seven years has been works manager of the company's North Woolwich factory. Supporting Mr. Anderson in India, in the capacity of plant engineering adviser, will be **Mr. A. W. White**, formerly the firm's headquarters plant engineer.

Mr. L. E. Anderson

Previously head of the Design and Construction Branch of the State Electricity Commission of Victoria, **Mr. E. L. Merigan**, B.E.E., has been appointed Associate Commissioner of the Snowy Mountain Authority, Australia, for a period of five years at a salary of £2,500 a year. He is to specialise in the electrical and mechanical engineering side of the project. The other associate commissioner, **Mr. T. A. Lang**, former officer of the State Rivers and Water Supply Commission, who was appointed last year, is to specialise on the civil engineering side. Victoria's representatives on the standing committee of technical advisers to the Snowy Mountain Authority will be the chairman of the Water Supply Commission **Mr. L. R. East**, and the assistant to the general manager of the State Electricity Commission, **Mr. W. H. Connolly**, B.E.E., B.Com., A.M.I.E.Aust.

Newly appointed head of the National College for Heating, Ventilating, Refrigeration and Fan Engineering, at the Borough Polytechnic, **Mr. N. S. Billington**, M.Sc., A.M.I.H.V.E., takes up his duties there on Monday next. For some time he has been principal scientific officer at the Building Research Station, Garston, Hertfordshire.

Sir Harry Railing, chairman and joint managing director of the General Electric Co., Ltd., accompanied by **Lady Railing**, sailed in the *Pretoria Castle* on Thursday last for an extensive tour of South Africa, during which he will visit the head office and branches of the British General Electric Co., Ltd., at Johannesburg, Capetown, Port Elizabeth, Durban, Salisbury and Bulawayo, and obtain first-hand knowledge of local conditions.

At their meeting last week, Manchester City Council confirmed the appointment of **Mr. H. F. Cork** as chief lighting engineer of the Corporation Highways Department. Mr. Cork is now public lighting and electrical engineer to Barrow-in-Furness Corporation.

At the dinner held recently to mark his retirement from the position of branch manager, at Swansea, to the General Electric Co., Ltd., **Mr. H. C. Runnals** was presented with a cheque on behalf of his colleagues and friends. Mr. Runnals joined the G.E.C. in Cardiff in 1904, being in charge of various departments until he went to Swansea in 1913 as chief assistant. In 1915, he was appointed to represent the company in Gloucester, Devon and Cornwall, but returned to Swansea in October, 1921, as manager of that branch. He is now succeeded in that position by **Mr. H. G. Morgan.**

The Minister of Fuel and Power has appointed **Lt.-Col. D. S. Kennedy**, D.S.O., J.P., M.I.Mech.E., M.I.B.Agric.E., as a part-time member of the Southern Electricity Board.

Two new appointments have been made by the Sloan Electrical Co., Ltd. **Mr. E. H. Maltby** is now sales manager of the company, and **Mr. F. French** is assistant sales manager. Both have been with the firm for a long time, Mr. Maltby for 16 years, chiefly as an outdoor sales engineer in London; and Mr. French for 24 years, latterly as manager of the wiring accessories department. Both are located at the Central London Store Depot, 31-35 Bondway, Vauxhall, S.W.8.

Mr. E. H. Maltby

Mr. F. French

Two new appointments, of general manager and of assistant general manager, are announced by W. T. Glover and Co., Ltd. The former position is now held by **Mr. D. T. Hollingsworth,** A.M.I.E.E., who was previously research (power cables) manager to British Insulated Callender's Cables, Ltd. He originally joined the old Callender's Cable and Construction Co. as a works trainee in 1925, subsequently holding positions in various departments. Glovers' new assistant general manager is **Mr. J. W. Porter,** who first served with the Estimating and Order Departments of the company in 1910. He was appointed London representative in 1924, and became joint sales manager in 1946.

Mr. D. T. Hollingsworth

Mr. J. W. Porter

Mr. R. L. Kay, A.M.I.E.E., has been selected as senior assistant to the steam testing engineer, North Eastern Generating Division of the B.E.A.

Below we show a group photograph of the Central Authority of the B.E.A., as now constituted, with the change in the representation of Area Board chairmen. The group is not complete, however, for it does not include Sir William Walker, who was unable to be present when the photograph was taken. In the back row are seen (left to right) Messrs. L. Howles, C. R. King, Dame Caroline Haslett, Sir Norman Duke, and Norman Elliott; while in the front row are: Lt.-Col. E. H. E. Woodward, Sir Henry Self, Lord Citrine, Sir John Hacking, E. W. Bussey, and Rt. Hon. T. Johnston.

Newly appointed manager of the Water Heating Sales Department of the Simplex Electric Co., Ltd., is **Mr. E. S. Chisholm,** who was latterly a district commercial officer in the Chiltern sub-area of the Eastern Electricity Board. He received early training with the G.E.C. at their experimental test room at Wembley, and later served with the Normet Power Co. Mr. Chisholm is based at Oldbury for the time being, but will later operate from the Simplex factory at Blythe Bridge, near Stoke-on-Trent.

Mr. E. S. Chisholm

Mr. I. A. R. Stedeford, chairman and managing director of Tube Investments, Ltd., is leaving Britain by the R.M.S. *Queen Elizabeth* on Feb. 15, on a business tour, during which he will visit the United States, Australia, New Zealand and South Africa. He will travel by air after his arrival in America. He will be accompanied by **Mr. E. D. E. Andrewes,** managing director of the Tube Investments export organisation, T.I. (Export) Ltd., and will return to England in mid-April.

A memorial service for the late Col. **Sir Thomas Purves,** O.B.E., has been arranged by The Institution of Electrical Engineers, in co-operation with the C.M.A., to be held at the King's Chapel of the Savoy, Savoy Street, W.C.2, on Wednesday, February 15, at 2.30 p.m., and will be conducted by Prebendary W. L. Cottroll of that Chapel.

OBITUARY

We regret to note the death on January 29, of **Mr. H. W. Kent,** aged 76, director of Davies, Kent and Stewart Ltd.

The death occurred on February 5, of **Mr. A. H. Meysey-Thompson,** M.INST.C.E., J.P., one of the founders of the Yorkshire Electric Power Co., of which he was a former vice-chairman.

The group at a meeting of the newly-reconstituted Central Authority (Sir William Walker was absent)

FAULT-THROWING ON THE GRID

Investigations into Protective Gear Failures

DURING the war trouble was experienced with the carrier-current protective equipment installed on the Northfleet-Woking feeder. This feeder is about 40 miles long and includes 3½ miles of oil-filled cable near its mid-point. The high-speed carrier-current protective equipment was installed in 1942, and in 1944 the feeder was subjected to a large number of faults mainly due to the overhead-line portion coming into contact with wires from escaped barrage balloons used in the defence of London against flying bombs. There were 24 such faults, 12 of which were not cleared correctly. An investigation was therefore carried out on this section of 132 kV line to find out the causes of these failures, which were characterised by failure to trip, or delayed tripping only at that end of the feeder which was on the same side of the cable section as the fault.

Details of the investigation were given by Messrs. W. Casson and F. H. Birch in a paper "Fault-throwing Tests on the 132 kV Grid System under Normal Working Conditions," presented to the I.E.E. last week.

They pointed out that owing to the attenuation in the cable, and the fact that the maximum power transmitted on the 100 kc/s carrier system was limited to 10 watts by P.O. regulations, the carrier receivers had to be set to operate at 0·25 volts instead of 2–10 volts as was usual on other feeders.

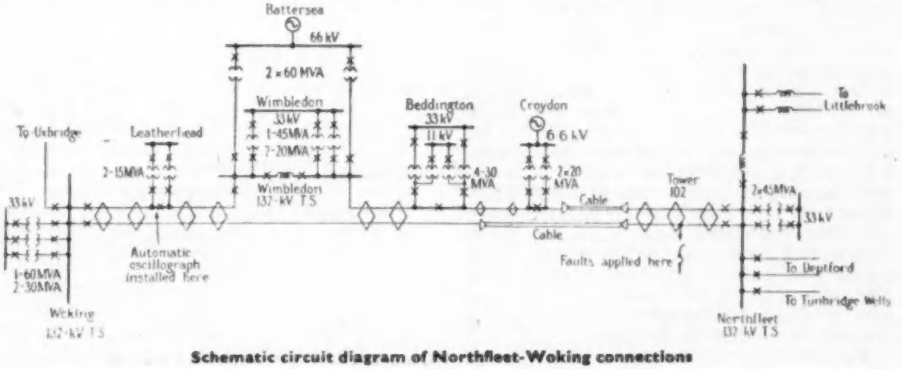
Preliminary Investigations

Records of the faults had been obtained on the automatic oscillograph at Leatherhead and showed that in five cases, although correct protective-gear discrimination had been obtained, the operating time of the carrier-current protection was unduly long. Following the unsatisfactory operations in 1944, the carrier-current protective equipments at Northfleet and Woking were thoroughly tested by secondary injection and were found to be working as designed. It was suspected that the delayed tripping and failure to trip might be due to h.f. interference produced by the fault arc. As a first step therefore, arcing faults were produced on the Northfleet-Woking line in May, 1945 by blowing fuses at 400 volts with currents of about 100 amp. No carrier interference was detected.

Arcing faults were then produced on the same line when energised at 132 kV. An isolated 30 MW generator was used, the arc being initiated by the blowing of a fuse across a horn gap between one phase and earth. The fault current was about 500 amp for one second. In one instance the fault was applied to one of the two phases used for carrier transmission and in another instance to the remaining phase. In all cases a burst of interference lasting 2–2½ cycles was recorded when the fault commenced, and a second burst while the fault was being cleared. These did not account for the failures to clear. It was therefore arranged that six faults should be applied with the line running under normal operating conditions.

Full-scale Tests

The equipment used for the full-scale tests was located five miles south-west of Northfleet, at a site where faults had caused three incorrect clearances. From the line the three phase feeders were brought down to a framework supporting three 132 kV line isolators. From the isolators a connection was made to a set of horn gaps bridged with fuse wire and then to three more isolators, the other side of which were connected to a common earth fault connection. The second set of isolators were remotely controlled from a pushbutton located about 30 ft away.



Schematic circuit diagram of Northfleet-Woking connections

At the fault site, slip-on type current transformers and high-speed ammeters with maximum indication were provided. High-speed ammeters were also installed at Woking, Northfleet and intermediate stations. Also at Northfleet was installed a 15 element cathode-ray oscillograph to record various currents, voltages, h.f. measurements and the contact operations of the relays. In addition the E.R.A. high-speed cathode-ray oscillograph was connected. At Woking a 3-element Duddell oscilloscope was used to record fault currents in one phase, contact operation of relays and relay operating coil current.

Owing to the large number of observations required simultaneously, short-wave radio-telephone equipments were used between the fault site, the control room at Northfleet and the P.O. test van. Prior to the actual fault-throwing, a thorough test was made of main and back-up protection on all neighbouring 132 kV feeders. As no definite information was available as to which type of fault would produce the most carrier interference it was decided that the first test should start between one phase and earth and develop to all three phases in stages.

The first test was with the arcing horns set 28 in. apart and bridged with 18 gauge copper wire. When the fault was applied, the arcs rose to a height of six feet and the fault was cleared by the overcurrent relays. The Grid however received a considerable shock and all three phases were affected during 19 cycles until the main infeed from Northfleet was cleared.

For the second test it was decided to have the fault between one phase and earth and to connect the Tunbridge Wells feeder to Littlebrook instead of Northfleet. In both these tests there was an absence of sustained interference of appreciable magnitude.

No. 3 test was made on the yellow phase in which there was no wave trap, and Woking arranged to clear first. Again there was no appreciable interference. After reviewing the information obtained from the previous tests, it was thought that sustained interference at Northfleet might be obtained by applying a complex fault and clearing it at Woking some time before Northfleet. The arcs in this test rose about 10 ft, but again the expected interference was absent. For test 5, a simple phase to earth fault was selected, and to increase the inductive interference for the benefit of the P.O. engineers, the direct connection from the tower leg to the earthing connections in the test enclosure was removed. Although extensive arcing took place the protection performed as in previous tests, and was unaffected by the removal of the earth connection to the tower.

The final test was a complex fault clear of earth. The arcs appeared to be more vivid and the explosions louder than in the previous tests. It was observed that the current in the 132 kV series reactor at Northfleet oscillated between zero and full load for about 10 seconds after the fault infeed from Northfleet had been interrupted. The carrier-current protection trip relay operated without delay, but the oscillograms showed that this might have been fortuitous. At Woking the lock-out relay operated six times during the fault.

The results of the tests and reproductions of the oscillograms are included in the paper.

Conclusions

Although the tests did not produce the bad operation of the protective gear anticipated, a closer examination of the oscillograms of test No. 6 indicated that interference of considerable magnitude and duration could have been caused by faults imposed by balloon cables causing sparking. The attenuation of the h.v. cable section in the circuit was considered to be the cause of non-tripping at one or other of the ends of the feeder. The behaviour of the lock-out relays at the start of test No. 6, and in a subsequent corroborative test, confirmed this.

While the tests showed that the protection operated satisfactorily on earth faults, they drew attention to its weakness on faults clear of earth. Modern carrier-protective systems working on the phase-comparison principle were less prone to mal-operation in these

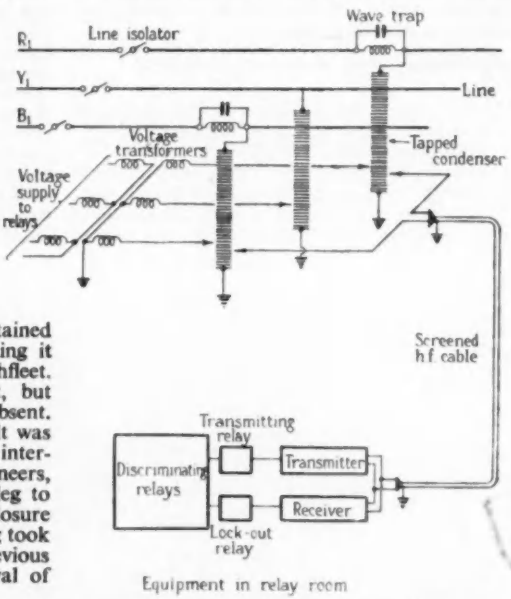


Diagram showing carrier connections to 132 kV lines

circumstances as they were responsive to a combination of phase and earth currents and never to earth currents alone.

It was finally concluded that the interference was mainly caused by capacitative effects and not by the arcs or circuit breakers.

DISCUSSION

MR. C. W. MARSHALL (B.E.A.), who opened the discussion, referred to the reason for using carrier current protective gear, and said that distance protection of the reactance or impedance type had given reasonable performance with about 90% efficiency, but it was not possible to do any better with it, so that it was decided to revert to unit protection. The least expensive form of this was carrier current protective gear. As there was an interregnum between the C.E.B. and the B.E.A., the opportunity of conducting field tests was too good to be missed. The Authors spoke longingly of the opportunity to do further tests, but what amounted to an electrical observatory had been set up at Leatherhead, and it should be possible to get proper analyses of field faults.

MR. G. W. B. MITCHELL (Merz and McLellan), said he stood quite close to the breaker at Northfleet during the last test, and it cleared the fault without any fuss, and with hardly any more noise than when tripped by hand under no load. That showed that the duty on breakers on an actual system was very much less than on a test plant. The power factor on the 132 kV system under fault conditions was about 0·3, and that made an enormous difference to the breaker.

MR. F. J. LANE (B.E.A.), said that one reason for the tests was the decision to depend entirely on the carrier equipment for the protection of the circuit. Experience since the war had proved the protection to be both fast and selective. The year before last there were 34 faults, all cleared correctly, and last year only two failures occurred.

In this country it was not possible to be sure that over a long period of years all overhead lines would necessarily remain entirely overhead, and in planning a system it had to be borne in mind that sections of the feeder might have to be put underground sooner or later. It would be foolish, therefore, to develop a system of protection which could not be applied to circuits having a short length of 132 kV cable.

MR. E. P. L. WESTELL (G.E.C.) said that the tests described were of inestimable value to the telecommunication engineer responsible for the design of carrier equipment for communication purposes over power lines. Even before the war such tests, even on a small scale, were very rare, owing to the risk and expense involved, and carrier communication equipment had, therefore, to be designed on theories which had not been thoroughly tested in practice.

MR. J. J. EDWARDS (G.P.O.) said that the tests from the Post Office point of view were interesting, but not ideal, because of the complications of double circuit lines and also because of the variations of earth resistivity which were known to occur under such conditions. In the ordinary way, such things could be calculated from known theories but it was always useful to have tests to confirm the measured values, because it was obviously uneconomic for the power industry and the Post Office to provide unnecessary protection.

MR. R. K. EDGLEY (Reyrolle) said that carrier protection of the directional interlocking type had now been largely superseded by a more modern design working on the phase comparison principle, and it would be of value to examine the data available to determine whether such protection would operate satisfactorily under all conditions met with in practice, or whether the interference which might arise might adversely affect this type of protection.

There was evidence that the interference might be of the nature of pick-up rather than direct injection. It had been shown that h.f. interference arose at the time of opening and closing of circuit-breakers in series on a line which were outside the line traps which limited the path of the legitimate h.f. signals. If series arcing were to occur between the line traps the interference would be much greater.

MR. W. T. J. ATKINS (B.E.A.) mentioned that the Authors drew attention to the odd behaviour of their voltages and remarked that when a fault occurred at the top of a peak a good deal more subsequent distortion took place than when it happened as the voltage was more or less passing through zero, and they commented on its behaviour in the residual circuit in particular. He suggested that this might be a spurious effect, due to the measurements being made via capacitor type voltage transformers, which were, in effect, rather sharply tuned circuits, so that one was looking at a rather jerky signal through what was virtually a band-pass filter. The apparent displacement of phase might, therefore, not be as real as it appeared to be.

MR. G. LYON (A.E.I.), who was responsible for calculating the fault currents on the a.c. analyser, said that the agreement between the three sets of results was very good, and tended to support the view that the methods of calculation used were adequate, and that even the d.c. short-circuit calculating table was sufficient for the class of work described. It was important to bear in mind the assumptions underlying the calculation methods.

MR. L. GOSLAND (E.R.A.) agreed that the Authors' explanation of the cause of carrier interference—that it was due to capacitance sparking—was perfectly satisfactory, but was not convinced that the conditions which they suggested could arise with barrage balloons could have happened so frequently as 12 times out of 24. Results might be quite different with a strong wind blowing and with arcing between a conductor and a part of the tower where the electromagnetic forces were very different from the simple kind found in the test set-up

MR. J. P. CRANMER asked whether similar interference trouble was likely to be experienced with a post-war design of oil circuit-breakers, which would give a total clearance time of 0·03 sec, as compared with the 0·15 sec mentioned in the paper.

Mr. F. H. Birch replied to the discussion.

I.E.E. South Midland Centre

ABOUT 400 members and guests were present at the annual dinner of the I.E.E. South Midland Centre, held at the Grand Hotel, Birmingham, last Friday, with Mr. J. W. Donovan, B.SC.(HONS.), M.I.E.E. (chairman of the Centre) presiding.

The toast of "The City of Birmingham" was proposed by the chairman, and the Lord Mayor of Birmingham, in his reply, appealed for the close co-operation of the electrical industry in brightening Birmingham for the Festival of Britain.

"The Institution of Electrical Engineers" was proposed by Sir Henry Self, who commenced by paying a tribute to the late Harry Hooper, for so long the indefatigable secretary of the centre, not only for his services to the I.E.E., but for the work he had put into the Midland Division. Referring to the B.E.A. Report, Sir Henry caused amusement by quoting the *Economist's* comment that the report was "turgid and labyrinthine." Such criticisms might be levelled, but the report had been intended to put the whole story on record for the benefit of the public so that it could be shown as the years went by "not how we thought we should do it, but what had been done." The industry was free of politics, and he sincerely trusted that it would remain so.

On the question of plant shortage, he referred to two aims to be realised: diversity of load and a higher efficiency. If capital costs had trebled in the last 15-20 years, what other solution was there, save increase in the standard of technical achievement? The Scientific Advisory Council which had been set up had deliberately been constituted without engineers, to act as a challenge to the engineers.

Professor Moullin, who replied to the toast, also paid tribute to the late Harry Hooper. Referring to the work done by local centres, he instanced ten meetings in five weeks as an example of the hard work and enthusiasm for their profession by which the I.E.E. was doing so much to uphold the standard of professional competency. Britain had always been leader as well as a pioneer—two terms which were by no means synonymous—and its standard of competency was such that it would be in the lead, no matter what might be the difficulties under which the industry had to labour.

The senior vice-chairman, Mr. D. H. Kendon proposed the toast of "Guests and Kindred Societies." Sir George Nelson replied.

NEW LITERATURE

Direct Current Armature Windings

by C. S. Siskind

MOST courses in electrical engineering recognise the importance of armature winding theory, and devote considerable attention to it, but all too often the student is left with only a vague impression of some complicated diagrams and some rather dogmatic formulae. In the present volume Professor Siskind has developed an approach to the subject that makes the diagrams clear and relegates the formulae to their proper position as concise statements of understood principles.

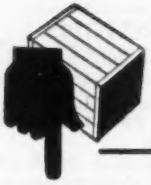
No attempt is made to provide a design manual; indeed, the work is intended for the shop worker, but the student will certainly benefit from study of the book, which is characterised by its wealth of large diagrams and its general spaciousness of expression. Lap and wave windings of various "plexes" are dealt with, and circulating current problems considered at length. The so-called "frog-leg" winding has two chapters to itself, and the book concludes with notes on machine calculations and on winding troubles. Devaluation has made the price rather high for the individual student, but the book will be a valuable addition to technical libraries. Published by McGraw-Hill, 149 pages, 10 by 7 in. **Price 25s. 6d.**

Industrial Electricity—Volume II, Alternating Currents

by W. H. Timbie and F. G. Wilson

INTENDED for technical school students with but little mathematical training, this book sets out to present the fundamentals of alternating current practice without a complicated analysis of isolated problems. An extensive chapter on the use of vectors in a.c. work sets a sound basis for the descriptive work to come, while short chapters on power factor, reactive circuits and power relationships consolidate this foundation.

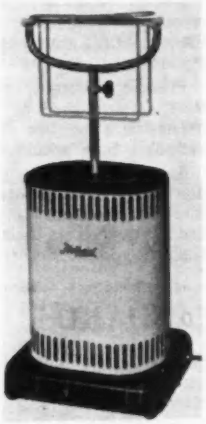
The main section of the book begins with a really well-presented chapter on alternator armature windings. The usual range of chapter headings follow—the alternator, transformer, induction motors, synchronous motor, transmission lines, converters and rectifiers and in all of these the Authors' explicitly stated plan "say what happens and then why it happens," is applied. For the student not specialising in electrical engineering, this American text book may seem rather long, but he will certainly benefit from its clear explanations of fundamental concepts. A useful feature for such a reader is the concise summary printed at the end of each chapter. Published by Chapman and Hall, 781 pages, 8½ in. by 5¼ in. **Price 48s.**



THE BUYER'S COLUMN

Re-Styled Hotpoint Clothes Dryer

THE portable electric clothes dryer marketed by the Hotpoint Electric Appliance Co., Ltd., of Crown House, Aldwych, W.C.2, has now been re-styled. Finished in cream enamel, the new dryer has a black stove-enamelled base with black enamel top cover plate. A central tube supports the heavy gauge plated folding arms.



Loading is 1½ kW in two equal sections; one section being controlled by an element in the base. Suitable for 200-210, 230-250 V, a.c. or d.c., the dryer is supplied complete with fabric cover and 9 ft of 3-core cable at a retail price of £7 10s., plus purchase tax £1 9s.

No Backaches With This Mower

FROM the manufacturers, H. C. Webb and Co., Ltd., Tame Road, Witton, Birmingham, comes news that "Webb" electric lawn-mowers will be available in greater numbers for the home market this year. The mower is also offered in an improved form. The 1950 model incorporates three principal improvements: the motor and switchgear is now totally enclosed, the handles and switch levers are covered in insulated plastic material and the grass box is flanged each side to give greater capacity. Despite these improvements the price remains the same: £28, plus purchase tax £7 5s. 7d. The mower is powered by a ½ h.p. "Hoover" motor controlled by 2-pole safety switch which allows the cutting cylinder to rotate at 750 r.p.m. giving an unlimited number of "cuts per yard" and thus ensuring no "ribbing."

"Osram" Instant-start Lamps

NEW gear for "Osram" fluorescent lamps is announced by the General Electric Co. The 4 ft, 40 W (Natural and Daylight) and 2 ft, 40 W (Natural) lamps are now available with earthing strips for use in instant-start circuits at an extra charge in each case of 1s. above the standard price. The 4 ft, 40 W lamps are for operation with the existing F.8008 instant-start transformer on 200/230 V main supply. A new starting transformer to cover higher mains voltages will be available shortly.

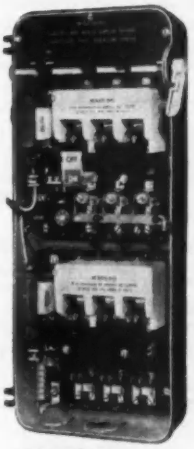
For use with the 2 ft, 40 W lamps, arranged two in series, is a new transformer, F.8012. It is suitable for voltages 220 V to 250 V. When used with 4 ft and 2 ft lamps, both transformers are for inductive circuits only.

Creda Price Reductions

LATEST information from Simplex Electric Co., Ltd., Oldbury, Birmingham, shows considerable reductions in the prices of "Creda" heavy-duty cooking equipment. The model 2882 steaming oven drops in price from £110 3s. to £95. Roasters are also included in the change. Model 2401 is reduced by £6 2s. 6d. to £58; 2421 from £128 5s. to £116 and model 2425 from £110 12s. 6d. to £100. The vitreous enamelled heavy duty ranges have comparable price reductions. Model 2404 drops £16 1s. 3d. to £75; 2424 drops from £182 2s. 6d. to £154; model 2406 from £77 2s. 6d. to £64 and model 2426 by £23 5s. to £131.

An Advance in Starter Design

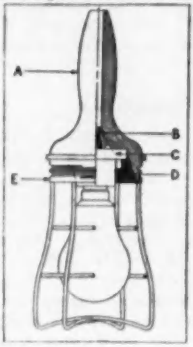
RECENTLY added to a wide range of first quality switchgear is the ZSD Brook automatic star-delta switching starter produced by Brook Motors Ltd., Empress Works, Huddersfield. Designed for use where the starting current of squirrel cage induction motors must be limited to 150/200% full load current with 33/60% torque the starter, a totally enclosed air break contactor type automatic switch, with no volt and overload protection, complies fully with the requirements of B.S. No. 587. The case is of robust cast-iron construction whilst the panels and contactor arms are in moulded plastic. Operation is entirely automatic, the change from star to delta connection being controlled by a thermal time delay switch adapted for three delay times to suit the motor application. Also added to the Brook range in a similar pattern designed for flush cavity mounting, is the ZTF model. It is available for single and 3-ph. systems. List numbers are 660 and 662.



The ZSD starter with cover removed

Just the Lamp for a Garage!

LATEST addition to their range is the newly-designed garage inspection hand lamp just released by Rowlands Electrical Accessories, Ltd., R.E.A.L. Works, Hockley Hill, Birmingham 18. New and unique features of the hand lamp are: (*a*) handle moulded from special oil resisting rubber carrying (*b*) a rubber moulded cord grip. The porcelain lampholder (*c*) rests in a shaped recess in the moulding of the handle and is surrounded by a third rubber mounting (*d*) The zinc-plated wire guard is mounted to a threaded retaining ring (*e*), which effects complete assembly of the lamp, there being no screws, nuts or other fittings to come loose. The whole lamp is shock-proof and unaffected by vibration. Complete with bayonet cap holder, the price is 15s. without advance, or with E.S. holder at 17s. 4d.



TRADE PUBLICATIONS

TELEPHONE EQUIPMENT. New publication No. 834/2, from Communication Systems, Ltd. (A.T.M. subsidiary) presents in an attractive manner details of "Strowger" private automatic telephone exchange equipment.

TRACTION BATTERIES. Information which will prove valuable to all operators of electric vehicles will be found in the latest catalogue of the D. P. Battery Co., Ltd. The development of electric traction batteries, and in particular "Kathanode" batteries, is reviewed and is backed up by a series of interesting performance curves.

SOUND REPRODUCING EQUIPMENT. Many reasons why industry needs S.R.E. by Philips Electrical Ltd., are summed up in their latest leaflet P.A.1473/1.

PHONIC MOTOR TIMING DEVICES. Bulletin B.601.C. published by Muirhead and Co., Ltd., illustrates a number of these important devices including brief specifications.

SWITCHGEAR. An original woodcut of one of the first circuit-breakers forms an interesting introduction to a brochure issued by Dorman and Smith Ltd., illustrating their present-day range of medium voltage air break switchgear.

BRITISH STANDARDS

Glossary of Terms Used in Radio Propagation. *Supplement No.* 2 (1949) *to B.S.* 204: 1943, price 2s.—Radio propagation through the ionosphere and the troposphere is the subject covered by this glossary. The object, as set out in the foreword to the parent standard, is "to standardise and co-ordinate the technical terms used in telecommunication." Twenty-eight terms applying to the ionosphere are defined, and 14 for the troposphere. In addition, 15 letter symbols are tabulated.

Fundamental Radio Terms. *Supplement No.* 3 (1949) *to B.S.* 204: 1943, price 1s.—Fourteen fundamental branches of radio are defined in this supplement, and their relationships are illustrated in a line diagram which is included.

Ceramic Materials for Telecommunication and Allied Purposes. *B.S.* 1598: 1949, price 4s.—One of a series of standards intended mainly for designers of electrical equipment, this specification is principally concerned with the provision of methods of test which will permit the comparison of technical data.

After a list of appropriate definitions a classification of materials is given according to power factor, permittivity, loss factor and temperature coefficient of capacitance. Tests for electrical, thermal and mechanical properties are specified, the conditions of such tests being detailed in appendices.

Anodic Oxidation Finishes for Aluminium and Aluminium Alloys. *B.S.* 1615: 1949, price 3s.—Electrolytic anodising of aluminium has now many applications besides its original purpose of increasing the corrosion resistance of aircraft alloys. In consequence the need for some standard has grown, and the present specification is the outcome of a request by the Aluminium Development Association. Thickness of anodic coatings, reflection factors, resistance to abrasion and fastness to light are the qualities covered by the specification. Resistance to corrosion is still under consideration.

Appropriate definitions are set out, and then limits for the properties discussed above are laid down. Extensive appendices detail the methods of test.

Cables and Flexible Cords for Electrical Equipment of Ships. *B.S. 883: 1949. Price 7s. 6d.*—A revision of the 1940 issue, this standard differs from its predecessor mainly in the addition of polychloroprene cables and communications types to the v.i.r. list, and to the addition of new sections on cables with fire-resisting cables, 660 V varnish cambric insulated p.c.p. sheathed types, and m.i.c.c. The section dealing with tests has been rearranged, and advances in testing methods and rubber technology taken into account.

Part 1 of the standard gives general information, including copper constants. Part 2 deals with v.r.i. cables, parts 3, 4, 5 and 6 are the new sections referred to above, part 7 dealing with tests. Finally come a further 33 tables giving the dimensions of the various standard cables.

British Standards can be obtained at the prices stated from the B.S.I. Sales Department, 24 Victoria Street, London S.W.1.

THE WEEK IN NEWS

E.D.A. Area Organisation Disbanded

QUIETLY—no official statement has yet been made by the Association headquarters—E.D.A. area offices are being taken over by the Area Boards. Already offices in Birmingham, Glasgow, Leeds, Manchester and Newcastle have closed. In many cases the staff have joined the nearest Area Board.

For some time the fate of E.D.A. Area offices has been in the balance and apparently it has been decided that Area Boards can take over the work of E.D.A. in the provinces. Close association between the Area Boards and E.D.A. is being maintained by a panel of liaison officers which held its first meeting in January.

Power for Atom Research

SIMULTANEOUSLY with construction work on the new atomic energy establishment at Capenhurst, a power station to supply the necessary electricity is to be erected. Already B.E.A. have investigated a proposed site about seven miles from Capenhurst, for a base load station, with two 60 megawatt generating sets. Poor water supplies in the area will necessitate the use of cooling towers. Since the atomic establishment is expected to be ready by the end of 1952, the power station will have to be given top priority.

Preparations for New T.V. Stations

ALL orders for T.V. transmitter equipment to complete the first stage of the announced programme of television expansion have now been placed. E.M.I. are to supply two 50 kW vision transmitters, and Standard Telephones and Cables Limited to provide the associated two 12 kW sound transmitters for T.V. stations to be built in Scotland and near Bristol. Prospective site for the Scottish station at Kirk of Shotts is near Harthill and almost midway between Edinburgh and Glasgow. Location of the Bristol Channel station depends on site tests now in progress in South Wales and North Somerset.

A site near Northallerton, Yorks, has been selected for a T.V. station to link Newcastle-on-Tyne station to Holme Moss. The site is 730 ft above sea level at Scarth Nick, and the new station will be completed by 1951. It will not be a direct transmitter, and the telecast will not be picked up by the normal television set.

High Frequency Heating

A SPECIAL course of four weekly lectures on "High Frequency Heating in Industry" is to commence on Friday, February 24, at the Polytechnic, Regent Street, W.1. Although to be presented in such a manner as to be readily understood by those of average scientific attainment, the impact of recent research will receive adequate attention. The lecturers, J. A. L. Wharton, R. E. Bazin, P. M. Paine and E. S. Wilson, are members of the research and design staff of Redifon, Ltd. Fee for the course is 10s., and each lecture begins at 6.30 p.m.

Electricity Serves the Farmer

E.D.A. and Eastern Board took advantage of a recent conference on "Farm Buildings" at Hitchin to exhibit models and photographs illustrating the use of electricity. About 400 agriculturists, some from as far away as Scotland, attended the conference. Exhibits on the auditorium stage included models of barn hay drying by E.R.A., and a continuous grain dryer with storage bins, by Aldersley Engineering Co. E.D.A. had an automatic hammer mill on show, and Eastern Board demonstrated ventilated bin grain storage, and exhibited farm wiring.

Housecraft Advisers' Conference

A VISIT to the Ideal Home Exhibition, E.D.A. films and discussions on electric cookers and washing machines are among the attractions promised for the fifth post-war conference of housecraft advisers and senior demonstrators and showroom assistants. Organised jointly by E.A.W. and E.D.A., the conference will be held in London from March 28 to 31.

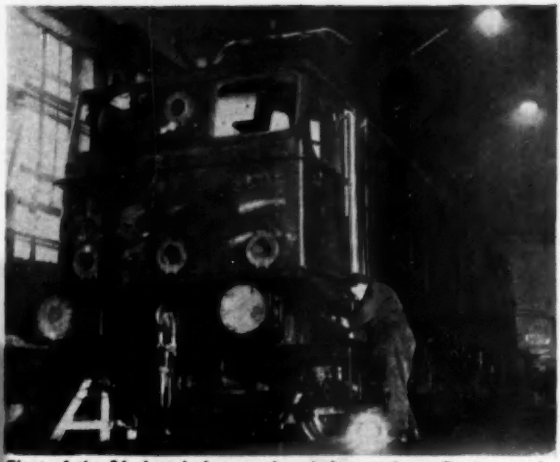
The first three days' proceedings will take place in Cowdray Hall, Henrietta Place, off Oxford Street, W.1. Last day will be spent at Connaught Rooms, Great Queen Street, W.C.2. Dame Caroline Haslett, director of E.A.W., will preside at the opening session.

E.D.A. Public Speaking Preliminary

FOR the second year in succession, Mrs. M. Alcorn, a demonstrator at Eccles service centre, goes forward to represent North Western Board in the finals of the E.D.A. public speaking

The First Half Century

The youngest station on the Surrey side (Lambeth) has already a police court conviction to its credit. Mr. Hopkinson was called upon last week to hear of its misdeeds in giving off clouds of black smoke, whereby the London County Council and certain residents in the district were induced to press, through the Lambeth Vestry, for an abatement of the nuisance. For the defence it was urged that every possible precaution had been taken to prevent the issue of black smoke, but in the face of the present coal famine it was practically impossible to obtain a decent class of fuel.—*From our issue February 8, 1900.*



First of the 84 electric locomotives being made at Gorton works for British Railways, nears completion

competition. She headed an entry of eleven ladies in the N.W. finals held in Manchester last week.

Mrs. Alcorn, who spoke on "Electricity in Schools," had to face extremely keen competition from her ten rivals. Second and third were Miss J. Keggen, a trainee demonstrator at Stockport, who also chose "Electricity in Schools" as her subject, and Miss E. J. Moore, a demonstrator at Manchester Central service centre, who spoke on "The Nation's Food Supplies."

Old Stagers Throw a Party

LAST Thursday was "Old Timers' Night" at Wembley Town Hall, where the Long Service Association of the British Thomson-Houston Co. Ltd., held their fourth annual reunion, at which 530 members, sweethearts and wives were present. In addition to dancing, there was a cabaret which involved occasional unrehearsed participation by members of the audience, with results which were highly entertaining to the remainder. The high spot was a bedtime number performed by some of the more senior members of the L.S.A. themselves, in slumberwear appropriate to various ages and sexes. The serious business of the evening consisted of the presentation of quarter-century certificates to those members who had qualified since the last reunion. These were:—

Mr. E. A. Alexander; Mr. C. Bell; Mr. C. H. Bradbury; Miss M. A. Burford; Mr. H. S. Clifford; Mr. E. A. Coombs; Mr. E. W. Dixon (30 years); Mr. D. T. Edmunds; Mr. F. Elsom (31 years broken); Mr. A. C. Evans; Mr. W. H. Evans (31 years broken); Mr. G. H. Haynes (30 years broken); Mr. G. F. Louch (40 years broken); Mr. H. G. Lawrence; Mr. A. C. Manser; Dr. J. R. Mortlock; Mr. E. C. Pontin; Mr. B. J. Reddington; Mr. B. E. Revill; Mr. W. Roffey; Mr. J. E. Salter; Mr. C. Scoble; Mr. J. E. Scutt; Mr. W. C. Street; Miss M. M. Thompson; Mr. T. W. H. Walklett; Mr. J. E. F. White; and Mr. G. V. Watterson.

The presentations were made by Mr. E. H. Ball (managing director, B.T.H. Co.), who was himself, as an honorary member of the Willesden L.S.A., presented with a certificate by Mr. H. E. Cox (manager, B.T.H., Willesden).

B.I.F. Bigger Than Ever

ORGANISERS of British Industries Fair expect a 50% increase in the attendance of American and Canadian trade buyers at this year's fair. Taking place simultaneously at Olympia and Earl's Court in London, and at Castle Bromwich in Birmingham, from May 8 to 19, the 1950 B.I.F. will provide more than 3,000 firms with over a million square feet of stand space.

As part of the national drive for dollars, a special publicity campaign has been promoted in N. America, and in many cases the effect of devaluation and manufacturers' own cuts in export prices make British goods an economical proposition. No single trade or industry has been selected for special emphasis this time.

Safety Talks Include Electricity Warning

CONCERNED at the danger of fatal accidents to children from h.v. conductors on pylons, West Riding education committee have asked in their January *Schools Bulletin* that reference to overhead lines should be made during road safety talks.

Notes on the subject supplied by Yorkshire Division, B.E.A., comment that apart from the danger of electrocution, there is the almost certain result of a fall from about 50 ft, if a child makes contact with an o.h. line. A further point stressed is the possibility of death by indirect contact made by a coil of wire, a long pole or even a kite string.

This new lighting fitting in the Council Room, Indian Institute of Science, Bangalore, weighs 16 cwt and incorporates twenty-four 5 ft 80-watt Mazda "Daylight" fluorescent lamps

Section of the new showroom of Philament Electric Ltd. off Westminster Bridge Road

Deliveries of Steam Turbo-Alternators

THE total figure of 1407·5 MW of steam turbo-alternators of 10 MW and over delivered for home use in 1949 shows a considerable rise on the 1948 total of 876 MW. Figures given in the January edition of *Monthly Digest of Statistics* show that the monthly averages of exports increased from 39 MW in 1948 to 47·8 MW last year.

British Scientists to Check Foreign MSS.

SCANDINAVIAN scientists preparing original reports of their work in English often require the services of an English-speaking specialist to check their manuscripts. Under a new British Council scheme such assistance can be readily obtained. Copies of the work submitted through the Council's offices will be sent for checking to British scientists engaged in similar research. Arrangements have been made for the fees for these services to be paid in local currency to the overseas offices. Those who give assistance will be paid in sterling in Britain. The British Council itself will make no charge for its services.

Pinkston Contract Still in Doubt

NO definite decision has yet been made regarding the disputed placing of the contract for a turbo-alternator at Pinkston power station. By a narrow majority—six votes to five—Glasgow Transport Committee has recommended further consideration of the whole question, and the appointment of a consultant to advise the corporation on all tenders received for the contract.

The minority favoured reaffirmation of the committee's previous decision to accept the offer by the Metropolitan-Vickers Electrical Co., Ltd., for the whole contract, amounting to £285,229. Final decision now rests with the corporation.

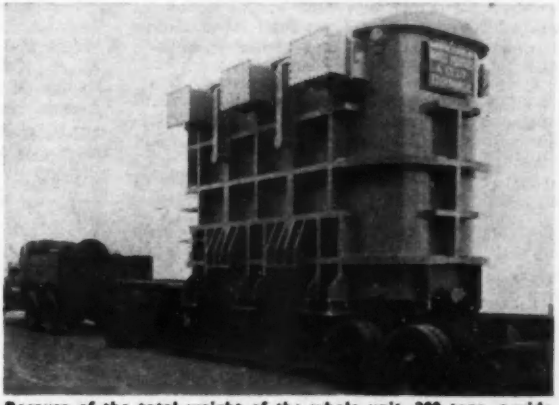
No Gloom Here

FORMING a cheerful oasis in a perhaps sombre part of the metropolis is the new showroom of Philament Electric Ltd. at St. George's Circus, Westminster Bridge Road, London. Although small in size the showrooms are so arranged that they show with advantage the elegant fittings produced by the company yet retain their air of intimacy. This is a new venture for Philament Electric who founded their works some years ago at the Bridgend Trading Estate in the centre of what was formerly one of Wales' depressed areas. Judging from the quality of the fittings there must have been a wealth of talent lying dormant in this development area. Our readers would do well to study the company's new catalogue or better still, pay a visit to this new showroom.

Portobello Gets a 75 MVA Transformer

TWO 200 h.p. diesel tractors—one in front and one behind—provided the motive power for the transport of the 100-ton transformer shown in our photograph. Built at the East Pilton works of Bruce Peebles and Co. Ltd., it is the first of two 75,000 kVA, 13,200-6,600/33,000 V generator transformers intended for Portobello.

Duplicate forced oil cooling is used, and each motor-driven oil pump is powered from an auxiliary supply. In the event of failure of a pump, a standby takes over automatically and an alarm is sounded in the power station. As additional



Because of the total weight of the whole unit, 200 tons, a wide detour had to be made with this 75 MVA generator transformer

safeguard, flow indicators in the oil and water pipes incorporate alarm contacts should the flow cease. Total weight of the complete unit, including 7,000 gallons of oil, coolers and oil conservator, is 130 tons.

Time Waits for No Horse!

RACEGOERS attending the state opening of Alexandria racecourse by King Farouk next Wednesday, will find two new 3 ft diameter electric clocks at the clubhouse. Part of a cabled order from Alexandria Sporting Club, the clocks were specially flown to Egypt by the makers, Gent and Co. Ltd. The complete order for a controlled electric clock system was only received on January 3, and our photograph shows the clocks being loaded into a B.O.A.C. flying boat at Southampton.

Two 3 ft diameter electric clocks made by Gent and Co., leave Southampton by B.O.A.C. flying boat for Egypt

Gent and Co. report good business with Egypt, particularly in clocks and clock systems. Recent orders include equipment for several Egyptian state authorities, and—in face of keen American competition—the Coca-Cola factory in Alexandria.

Duratube Entertains the Children

WITH a rhythm quartet providing a musical background and a programme including conjuring, ventriloquism and community singing, 120 children thoroughly enjoyed the annual party arranged by the Social Club of Duratube and Wire Ltd., Feltham. Some of the children sang solos of their favourite songs. Present at the party were Mr. Charles Odescalchi, managing director, Mr. J. W. Tydeman, general manager, and Mr. R. D. Smith, sales manager.

College Needs Electrical Overhaul

RENEWAL of electrical equipment at Wigan Mining and Technical College will cost £10,000, the general purposes committee reported at the last meeting of the governing body. Chairman of the committee, Councillor Guest, said that the equipment had not been generally overhauled for 50 years. Engineers of the North Western Electricity Board had recently inspected the existing wiring and found that fittings were dangerous in many places. Lighting in the assembly hall was insufficient for examination work. The committee suggested that in view of the cost, work should be spread over a number of years, and that the N.W. Board should carry out the most necessary installations at an early date.

NEWS IN BRIEF

About 200 members and friends spent an enjoyable evening at Telcon Staff Association's second annual dinner and dance in Pyne's Restaurant, New Cross.

A new daily experimental service of standard frequency transmissions from Rugby radio station will allow accurate calibration of radio and other electronic equipment. Frequencies used are 60 kc/s, 5 mc/s and 10 mc/s, with a power of 10 kW.

A total of £40,000 was raised during the 1949 Appeal for the Royal Commercial Travellers under the presidency of Mr. Leslie Gamage.

British business men attending the Foire de Paris, from May 13 to 29, will be invited to a banquet by the organisers of the fair.

Floor area of this year's Liege International Fair, to be held from April 29 to May 14, will be double that of 1949.

Fourth national U.S. plastics exposition is to be held at Navy Pier, Chicago, Illinois, from March 28-31. Enquiries should be made to Mr. W. T. Cruse, Executive Vice-President, The Society of Plastic Industry Inc., 295 Madison Avenue, New York 17.

Two further E.A.W. branches were formed at Perth and Worcester in January.

Increase of 4·5% in the number of women employed in wireless apparatus manufacture in the five weeks ending October 29, 1949, is disclosed in labour turnover figures given in the January *Ministry of Labour Gazette*.

Tickets for the Silver Jubilee luncheon of Electrical Trades' Commercial Travellers' Association can be obtained from H. Bowen, 69 Warwick Gardens, W.14, price 15s. each.

Survey on the suitability of Britsh packaging in the Canadian market, undertaken by B.E.T.R.O. for the Board of Trade, is to be published.

ELECTRIC SUPPLY NEWS

Eire

The new turf-fired generating station of the Electricity Supply Board at Clonsast, Offaly, has started to supply power, although not yet officially opened. The first of the station's two 12,500 kW steam turbo-generators is in operation. It is estimated that the station will consume some 120,000 tons of turf annually.

Portishead

The efforts of the B.E.A. to turn into good agricultural land an area around Portishead generating station has been criticised by local farmers. The land, a 90-acre site, is on the Bristol Channel seaboard, and is used as a tipping ground for 140,000 tons of ashes a year from the power station. The ground is being covered with ashes to a depth of 12 to 14 ft. and then, with three to four feet of topsoil and subsoil preparatory to sowing. It is estimated that this reclamation work costs about £500 per acre. Farmers also fear that when a second station is erected at Portishead, adjoining farming land would be encroached upon.

Rushden

A public inquiry was held recently into the application of the East Midland Electricity Board to erect overhead lines in the area. The U.D.C. objected on the grounds of amenities. To use underground cables, it was stated, would raise the cost of the scheme by £1,500.

Southern

The high cost of coal in Southern England and its consequent reflection on electricity tariffs was discussed at the recent meeting of the Southern Electricity Consultative Council. The discussion arose upon consideration of the annual report of the Board, in which it is stated that during 1948-49 the price of coal varied between Generating Divisions by as much as 23s. per ton—equivalent to approximately 0·2d. p.u. These higher prices are reflected in the Board's minimum running charge in the domestic and commercial two-part tariffs, which is 0·875d. p.u. as against 0·75d. p.u. in other areas. The chairman of the Council said there might be a case for equalisation of tariffs throughout the country, and it was agreed to obtain details of tariffs in other areas, in order that a question on the matter could be asked at the next Conference of Consultative Council Chairmen.

Westminster

The City Council Housing Committee has reported, regarding the Pimlico Housing Estate, that it was originally intended that all 495 flats in Section 1 should be wired for electric lighting and for heating (additional to the central heating), but that only one-third (165 flats) should be wired for electric cookers, refrigerators and washboilers. The remaining two-thirds (330 flats) were to be carcassed for gas equipment, the charge of the North Thames Gas Board for this being £8 5s. per flat (a total of £2,722 10s.). The latter Board has now offered to install the necessary gas services for cooking, refrigeration and laundry facilities for all flats in Section 1 at a charge of £4 7s. per flat (total £2,153 5s.), while stipulating that if only two-thirds of the flats are piped for gas equipment their charge would be £8 5s. per flat. Under this new offer the Council would save £569 on the expenditure previously anticipated for installations in the flats in Section 1. The London Electricity Board has also made a new offer under which it would be prepared to contribute a sum not exceeding £1,745 for wiring cookers, etc., in the former gas-only flats in Section 1, provided that any additional cost would be borne by the Council. It is considered that these two offers present the Council with an opportunity which may not recur, of carcassing and wiring all flats in Section 1 at a cost which is not likely to exceed the total cost of the part gas, part electricity installations formerly intended, and of giving prospective tenants freedom of choice between gas and electricity for cooking, etc. The committee has therefore recommended that the offers be accepted.

LIGHTING SCHEMES

Antey (Leics.).—The Parish Council is to investigate the possibility of changing the street lighting from gas to electricity.

Bolton.—Application is being made to borrow £11,915 to cover the cost of improved lighting on various roads during the year 1950-51.

Cardiff.—At the recent meeting of the Town Council, some protest was made at the refusal of the M.o.T. to sanction a second instalment of £10,000 from the original £40,000 loan for repairing and converting street lighting to electricity. The Ministry had asked that further plans be deferred for a year. The borough surveyor was instructed to report on the plans for conversion and to send information about out-of-order lamps to the Ministry.

Ebbw Vale.—The new fluorescent street lighting was officially inaugurated recently. Installed by the General Electric Co., the scheme includes 33 standards.

Harrow.—The U.D.C. has agreed to share with Hendon, at an estimated cost of £1,750, a scheme for improved lighting at Elstree Hill.

Kingston.—The proposal of the Ministry of Transport for a uniform system of lighting on Kingston By-pass Road has not met with much success. The Surrey County Council has reported that Surbiton Council is not prepared to co-operate; Malden and Coombe Council states that it is preparing its own scheme for its section of the road; Esher Council is unwilling to make a contribution towards the cost at present, and

Merton and Morden Council wants the proposal more clearly defined. These views have been forwarded to the Ministry.

Middlesbrough.—The T.C. is to consider the possibility of replacing gas lighting on main roads by electricity.

Newcastle-under-Lyne.—The Highways Committee has approved proposals to install new lighting along the whole length of the trunk road within the borough.

Sunderland.—The Corporation has been recommended to approve a scheme of illuminations. It is proposed to extend the display from Harbour View to the borough boundary, covering Roker and Seaburn frontage.

Tipton.—Application is being made to the Ministry of Health for consent to borrow £16,160 to cover the cost of electric lighting in a number of roads.

Westminster.—The City Council General Purposes Committee has recommended the Council to agree to the use of tungsten filament lamps for the new lighting in Parliament Square.

COMPANY ACTIVITIES

Palestine Electric Corporation

Consent of H.M. Treasury and of the Israel Government has now been obtained to the capital bonus proposed towards the end of last year. The distribution is to be of one fully paid Ordinary share for every six Ordinary or "A" Ordinary shares held on February 24; this will absorb £289,604 of the £290,888 standing to the credit of the share premium account. It is also stated that the directors do not consider it expedient at the present time to effect the increase in the authorised capital of the corporation referred to in the chairman's statement, but they have in contemplation the making of an issue of Ordinary shares for cash out of the unissued Ordinary shares and by the re-issuing as Ordinary shares of the 234,934 4½% redeemable Preference shares redeemed up to December 31, last.

Bylock Electric Ltd.

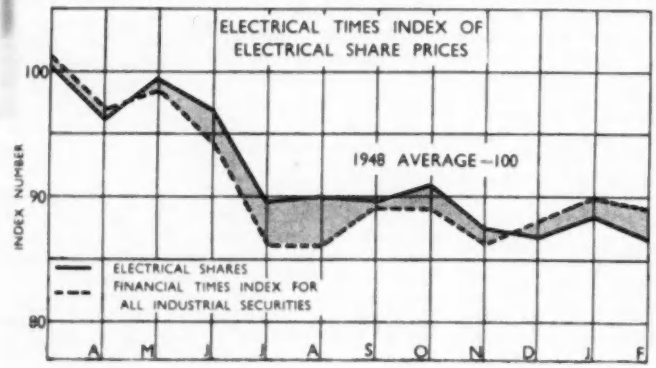
The full report for the year to July 31 last shows a net profit, before tax, of £14,986, compared with a net loss of £12,162 for the previous year. Taxation takes £7,276, leaving £7,427 carried forward after deducting debit balance of £283 brought in. The chairman, Mr. C. A. Mathes, states that the company's turnover has recovered to a point not very much below the years 1946 and 1947 during which trading conditions were vastly different from those of today. Wages and prices of materials have risen and it is feared that the devaluation of sterling will result in further increases while at the same time it has been found impossible to increase selling prices. The liquid cash position of the company continues to be difficult and the directors feel that although profits were earned during the year it would be most unwise at the present time to make any distribution by way of dividend.

Manx Electric Railway Company

For the year to September 30 last, operating profit was £14,006 (*£22,402*). Ordinary dividend of 2%.

British Industrial Plastics, Ltd.

For the year to September 30 last, consolidated trading profit amounted to £340,515 (*£383,448*), plus investment income £2,629 (*£14,991*), making £343,144 (*£398,439*). Allocations to research, development, etc., amount to £36,697 (*£29,406*), to pensions £13,445 (*£10,169*), audit fee £1,490 (*£1,491*), unrealised stocks carried by subsidiaries nil (*£15,000*), depreciation £80,704 (*£110,538*), tax £120,721 (*£141,595*), leaving a net profit of £90,087 (*£90,240*). With £43,174 (*£26,746*) brought in, and £10,000 (*nil*) from stock reserve, there is £143,261 (*£118,499*) available. To stock reserve nil (*£10,000*). Preference dividend £1,482 (*same*), ordinary dividend 20% £63,898 (*same*), leaving £77,881 carried forward.



SHARE PRICES INDEX

Our second index, calculated from the quoted prices of the Ordinary shares of nineteen electrical companies at the beginning of the month, shows that the slight rise during December was reversed in January. The "Electrical Times" share price index for February dropped 2.2% to 86.5% of the 1948 average, compared with a fall of 1.4% to 89% of the "Financial Times" index for all industrial shares, corrected on the same basis.

Commercial Information

CONTRACTS OPEN

The date stated is the last day for receiving tenders. Details of items marked • may be obtained on application to Room 1076, Board of Trade, Thames House North, Millbank, London S.W.1, quoting reference number.

February 10.—Carlisle T.C.—Provision and erection of lighting columns complete with lanterns in London Road and Newtown Road. City engineer, 18 Fisher Street, Carlisle.

February 10.—Droitwich T.C.—Electrical installation in 218 council houses. G. L. Robinson, engineer and surveyor, Town Hall, Droitwich. Deposit £2 2s. Advertised in Jan. 19 issue.

February 10.—Staffordshire C.C.—Complete portable electric welding kit. County surveyor, R. S. Mart, County Buildings, Stafford.

February 11.—Aberfeldy T.C.—Installation of electric light in Burgh houses in Tayside Place, Tayside Crescent, Market Street, Chapel Street, and Breadalbane Terrace. Burgh surveyor, Aberfeldy.

February 11.—Chadderton U.D.C.—Twelve months' supply of electric lamps. Engineer and Surveyor, Town Hall, Chadderton.

February 11.—Durham C.C.—Electrical installation at East Hetton new county school. County architect's office, Court Lane, Durham.

February 11.—Rothwell U.D.C.—Fifty-three high pressure sodium electric discharge lamps for various street lighting schemes. Engineer and surveyor's department, Civic Buildings, Rothwell, Leeds. Advertised in January 26 issue.

February 11.—Tettenhall U.D.C.—Supply, delivery and erection of street lighting on trunk road A41. J. W. Mason, engineer and surveyor, Council Offices, Tettenhall. Deposit £2 2s.

February 13.—Aldershot T.C.—Erection of nine electric lamp columns at Ash. F. W. Taylor, borough engineer and surveyor, Municipal Buildings, Aldershot. Deposit £1 1s.

February 13—Higham Ferrers T.C.—Installation of electric lighting in 33 cottages at Corporation Terrace and School Board Place. Borough Surveyor, Town Hall, Higham Ferrers.

February 13.—Southport T.C.—Electrical installations in permanent houses to be erected at the following sites: Four houses and four flats at Site No. 2, Drewitt Crescent; 12 houses at site No. 13, Balmoral Drive. Borough engineer's office, Town Hall, Southport.

February 13.—Wrexham R.D.C.—Wiring for electric light and power of 50 houses on the Rhosymedre site, Cefn, and 20 houses on the Bryn-y-Brain site, Rhos. Engineer and surveyor, D. E. Edwards, Imperial Buildings, Regent Street, Wrexham. Deposit £2 2s.

February 14.—Birmingham T.C.—Electric wiring in huts at Billesley Common Camp, Yardley Wood, Birmingham 14. W. Smith, general manager, Estates Department, 19-24 Summer Road, Birmingham 3.

February 15.—Aberdeen—Electrical work for houses being erected at West Park Street, Huntley, for Scottish N.E. Counties Police Board. County Architect's Office, 25 Union Terrace, Aberdeen.

February 15.—Belgium.—Various apparatus and accessories for telephone installations including cords, protectors and lamps. Regie des Telegraphes et des Telephones. B.o.T. (Ref. C.R.E. (IB) 40960/50).•

February 15.—East Kilbride Development Corporation.—Year's supply of electric domestic cookers and wash boilers from April 1. J. H. McLusky, secretary, Torrance House, East Kilbride.

February 16.—Poplar T.C.—Twelve months' supply of electric lamps. Town Clerk, Poplar Town Hall, Bow Road, E.3.

February 16.—Westminster T.C.—Supply of electric lamps, cables, etc., for 3, 6 or 12 months. Parker Morris, Town Clerk, Westminster City Hall, Charing Cross Road, W.C.2.

February 17.—Belfast T.C.—Supply and delivery of a loud-speaking telephone installation. J. Dunlop, town clerk, City Hall, Belfast. Deposit £1 1s. Advertised in February 2 issue.

February 18.—Armagh.—Electrical work at Lurgan Maternity and Child Welfare Centre, for County Health Committee. Architects, Houston and Beaumont, 6 Union Street, Lurgan. Deposit £2 2s.

February 18.—Egypt.—Supply of electrical switchgear delivered into store at Cairo. Director-General, Cairo Electricity and Gas Administration, 53 Fouad El Awal Street, Cairo, Egypt. Specifications from Chief Inspecting Engineer, Egyptian Government, 41 Tothill Street, S.W.1. Remittance £2 1s. per set, non-returnable.

February 18.—Felling U.D.C.—Electric wiring, fittings and equipment in 70 houses. D. W. Green, Housing Architect, Council Buildings, Felling, Gateshead 10.

February 18.—Sandown-Shanklin U.D.C.—Supply of amplification equipment, for installation in Concert Pavilion, Sandown Pier. Entertainments Manager, The Pavilion, Sandown.

February 19.—Persia.—Power plant for sugar beet factory. Sugar Industrial Commission, Seven Year Plan Organisation, Bank Sanati, Tehran. B.o.T. (Ref. C.R.E. (IB) 31741/49).•

February 20.—Preston T.C.—Electrical installation in 67 houses on Brookfield estate, part 1. Acting Borough Engineer and Surveyor, Municipal Building, Preston. Deposit £2 2s.

February 21.—Poole T.C.—Twelve months' supply of electric lamp bulbs, cables, fittings, batteries, water heaters and control units, street lighting lanterns, conduit and accessories. J. R. Barron, Borough Engineer and Surveyor, Municipal Buildings, Poole.

Due to limitation of space, Overseas Contracts are only published twice in the above section. A complete list is available for reference at our offices

February 24.—Burnley T.C.—Electrical installations for extensions to Towneley technical high school. Borough Engineer, Town Hall, Burnley. Deposit £1 1s. Advertised in this issue.

February 24.—Horwich U.D.C.—Twelve months supply of electric lamps. J. Seddon, Clerk of the Council, Council Offices, Horwich, Lancs.

February 25.—Evesham T.C.—Supply and erection of 34 high pressure sodium electric discharge street lighting lamps on Bath-Evesham-Lincoln trunk road. N. F. Davies, Town Clerk, 3 Leicester Gables, High Street, Evesham. Advertised in Jan. 19 issue.

February 27.—Cuckfield R.D.C.—Installation of electricity in houses at (1) Keymer; (2) Hassocks; (3) Hurstpierpoint; (4) Anstye; (5) Warninglid; (6) Slough Green; (7) Balcombe; (8) Ardingley; (9) Poynings; (10) Twineham; (11) Bolney; (12) Sayers Common; (13) Handcross; (14) Pycombe Street; (15) Horsted Keynes; (16) Albourne; (17) West Hoathly; (18) Crawley Down; (19) Copthorne; (20) Pound Hill; (21) Three Bridges. Engineer and Surveyor, A. Hutchings, Rural Council Offices, Boltro Road, Haywards Heath. Deposit 10s. 6d.

February 27.—Runcorn U.D.C.—Twelve months' supply of electric lamps. Engineer and Surveyor, Town Hall, Runcorn.

February 28.—Australia.—Supply of armoured control cable (Schedule No. 270). Secretary, Tender and Contract Committee, Department of Civil Aviation, 522 Little Collins Street, Melbourne, or Superintendent of Stores at Brisbane, Sydney, Adelaide or Perth.

February 28.—Australia.—Two 2,500kVA through-put auto-transformers, 11/6·6 kV, 3-phase, 50 cycles; four 2,500 kVA through-put auto-transformers, 22/11 kV, 3-phase, 50 cycles. Agent-General for New South Wales, Engineers Branch, 56 Strand, W.C.2.

February 28.—India.—Two 3,000 kW turbines with accessory equipment; two a.c. generators, continuous rating output, 3,000 kW; three water tube steam boilers, switchgear and accessories; three 500 kVA 3/3/0/4 kV station transformers. Chairman, Central Electricity Commission, Government of India, "Clevemont," The Mall, Simla 4. B.o.T. (CRE (IB) 37481/49).*

February 28.—S. Rhodesia.—Two 1,250 b.h.p. synchronous induction motors, r.p.m. at 50 c/s, 1,000 (alt. 1,500) for main pumping station, and two 850 b.h.p. synchronous induction motors, r.p.m. at 50 c/s, 1,000 (alt. 1,500) for booster station at Hunyani Poort pumping station. Town Clerk, Municipal Offices, Kingsway, Salisbury, S. Rhodesia. B.o.T. (CRE (IB) 37695/49)*.

February 28.—Tangier.—Lead cased cables with copper conductors of 6/10 mm section and paper insulation varying from 10-1,200 pairs, and in lengths of 510-4,000 m. 55,000 m lead cased cable with one pair cotton insulated 5/10 mm enamelled copper conductors. Telefonica de Tangier, S.A. B.o.T. (Ref. C.R.E. (IB) 40903/50).*

March 1.—Australia.—Tenders for 10, 20, 30 or 40 electric locomotives of 108 tons, 2,700 h.p., 1,500 V d.c. Specification No. 2, 190 for mechanical parts and installation; Specification No. 2, 189 for traction motors, control equipment air compressors and pantographs. Chief Mechanical Engineer, New South Wales Government Railways, Room 202, 19 York Street, Sydney.

No date stated.—Middlesbrough Education Committee.—Installation of electric lighting and power at education offices. T. R. Middleton, Education Architect.

CONTRACTS CLOSED

L.C.C.—Installation of wiring and fittings for electricity in 345 dwellings at Downham estate, Lewisham. LONDON BOARD (SOUTHERN SUB-AREA), £6,432 (accepted). Other tenders: AYR ENGINEERING AND CONSTRUCTIONAL CO., LTD., £6,531; RELIANCE ELECTRICAL CO., LTD., £6,653; IVERSON ELECTRICAL, LTD., £7,054; JOHNSON AND TANNER, LTD., £7,173; THORPE AND THORPE, LTD., £7,226; HAINES AND SHEPPARD, LTD., £7,629; T. CLARKE AND CO., LTD., £7,920; J. H. PLANT, LTD., £8,051; SAMUEL REED AND SONS, LTD., £8,343; POWERLITE ELECTRICAL INSTALLATIONS, LTD., £8,672; BUCHANAN AND CURWEN, LTD., £8,677.

Manchester T.C.—Electrical installation work on various housing schemes: 160 houses, A. E. SUDLOW AND CO., LTD.; 249 houses, H. C. TAYLOR AND CO. (Both recommended.)

Manchester T.C.—Electrical installations in "C" and "D" homes at Newholme, CASSON ELECTRIC CO., LTD. Installation of passenger lift at "C" and "D" homes, ETCHELLS, CONGDON AND MUIR LTD.

New Zealand.—Supply and delivery of 11,000 V switchgear for Fendalton main sub-station. FERGUSON PAILIN, LTD.

PRICES OF CABLE MATERIALS
(at Tuesday night)

COPPER, electrolytic	£153 0 0
LEAD, good soft pig (foreign)	97 0 0
" " "English" quality ...	98 10 0
TIN (99·99·75%) ... (Cash) ...	£599½—£600
" (3 months)	£583½—£583¾
ALUMINIUM, commercial purity (del.)	112 0 0
ARMOURING:	
Galv. Steel Wire (0·104 in.)	39 10 0
Mild Steel Tape (0·04 in.)	26 0 0

Note. Figures quoted are M.o.S. spot prices. For future prices the following premiums must be added:—	
For Copper delivered in 2nd or 3rd month after order (per ton)... ...	10 0
For Copper delivered in 4th, 5th and 6th month after order (per ton) ...	5 0 0
For Lead delivered in 2nd or 3rd month after order (per ton)... ...	2 0 0

BUSINESS NOTICES

Copper Cathode Discounts.—The Ministry of Supply has announced that as from February 1, copper cathode was increased from 10s. a ton to £1 a ton. The price of cathodes is now £152 a ton delivered. Other discounts and premiums remain as previously announced, but the following additions are notified to the schedule of premiums on imported shapes published on September 22, 1949: Rods ¾-in. in diameter and over, £14 16s. a ton; scalped wirebars, £1 10s. a ton. The current price of electrolytic copper (£153 per ton delivered) is not affected by this announcement.

Representation.—Mr. E. M. Williams has taken over the South Wales representation of the companies of which DAVID BROWN AND SONS (HUDDERSFIELD) LTD. is the head. He is attached to the group's Birmingham office, but works from his address at "Cremyll," High Cross Lane, Rogerstone, Mon.

PROSPECTIVE BUSINESS

Amble U.D.C.—Proposed erection of 20 Airey houses on Links estate. Surveyor, Council Offices, Amble.

Billingham-on-Tees U.D.C.—Erection of 62 houses on Roseberry Road and 4 houses and shops on Billingham Junction site. Architects, Kitching and Co., 21 Albert Road, Middlesbrough.

Bromley T.C.—Erection of 16 houses, 56 flats and 6 shops on Coppice estate. Borough Engineer, Municipal Offices, Bromley.

Bucks C.C.—Applications from firms for inclusion on Council's list of approved contractors. Specification: 23, refrigeration plant; 24, electrical installations. County Architect, County Offices, Aylesbury, by February 20.

Bury St. Edmunds T.C.—Proposed erection of first group of maisonettes on Mildenhall Road estate. Borough Engineer and Surveyor, Borough Offices, Bury St. Edmunds.

Chelmsford T.C.—Erection of 24 flats on Woodhall estate. Borough Engineer, Municipal Offices, Duke Street, Chelmsford.

Chislehurst and Sidcup U.D.C.—Erection of 8 houses at Barnham Road, 4 houses on south side of Victoria Road, and 4 flats on north side of Victoria Road. Ley, Colbeds and Partners, Palmerston House, Bishopsgate, E.C.2.

Colne and Chippenham R.D.C.—Conversion of ex-R.A.F. huts to temporary housing. Council Architect, Edwards and Webster, 32 Market Place, Chippenham. Deposit £3 3s.

Dublin T.C.—Erection of 190 houses at Ballygermot housing area. City Treasurer, Exchange Buildings, Lord Edward Street.

Dundee.—Eastern Region Hospital Board has approved in principle the rewiring of Perth Royal Infirmary at estimated cost of £7,000.

Eton U.D.C.—Scheme being prepared for installation of electricity in houses at Vaughan Gardens. Surveyor, Bridge Trust House, High Street, Eton.

Gateshead.—Remodelling of ward blocks at Bensham General Hospital at estimated cost of £75,000 is being planned by Newcastle-on-Tyne Regional Hospital Board, "Dunira," Osborne Road, Newcastle. Architect, F. H. Knighton.

Great Yarmouth T.C.—Erection of 78 Duplex type houses in pairs at Magdalen College estate. Borough Engineer, 15 Regent Street, Great Yarmouth.

Hiraethog R.D.C.—Erection of 12 houses at Cerrigydrudion. John Roberts, clerk, "Avondale", Llanrwst.

Leeds T.C.—Erection of 256 dwellings on Beckett Park Estate, Area 2. City architect, Priestley House, Quarry Hill, Leeds 9.

Liverpool T.C.—Erection of (a) 36 garages, Brook House; (b) 28 flats, Brainerd Street; (c) 10 houses, Ferguson Road, Queens Drive; (d) 12 flats, Juno Street, Wavertree Road. City Architect and Director of Housing, Blackburn Chambers, Dale Street, Kingsway, Liverpool 2.

Newcastle-on-Tyne T.C.—Contemplating erection of 6 section station and pillar telephones for police force at £5,120 each. City Architect, G. Kenyon, 18 Cloth Market, Newcastle-on-Tyne.

North Cotswold R.D.C.—Erection of 6 houses at Bourton-on-the-Hill and 12 at Chipping Campden. Council's Consulting Architects, Pemberton and Bateman, 21 Vure Street, Evesham, Worcs.

Shropshire Education Committee.—Erection of new primary school at Oswestry. J. B. Surman and Partner, 16 Harborne Road, Edgbaston, Birmingham 15.

South Shields T.C.—Electric washing machines are to be installed in 50 houses on Simonside estate.

Stamford T.C.—Names of contractors for erection of 54 houses at Drift Road to be forwarded to Council's Architects, F. J. Lenton and Partners, 16 Broad Street, Stamford.

Startforth R.D.C.—Erection of 10 houses at Cotherstone and 10 at Mickleton. H. B. Richardson, Architect, Skinnergate, Darlington.

Sunderland R.D.C.—To carry out in stages a £69,000 plan for improving old council houses including installations of electricity in houses not already supplied.

Westmeath C.C.—Construction of 25 cottages. County Secretary, County Buildings, Mullingar.

Weymouth and Melcombe Regis, T.C.—Erection of 86 houses in pairs and blocks of four on Downclose estate. Borough Engineer and Surveyor, 6 Pulteney Buildings, Weymouth.

OVERSEAS OPPORTUNITIES

Israel.—The "Telectra" Telephone Manufacturing Co-operative Society, Room No. 3, 35 Tel Aviv-Jaffa Road, Tel Aviv, desire to purchase from the United Kingdom the following telephone equipment: microphones (carbon, capsule type) max. dia. 57 mm., max. depth 27 mm., dials; automatic telephone exchanges for 10, 20, 24, 40 and 50 lines; and manual switchboards.

YOUR QUERIES ANSWERED

"Peak" refrigerators, makers of? T.E.—Peak Engineering Co. Ltd., New Street, Old Town, Stratford-on-Avon. (17622)

"Columbine" iron, makers of? T.E.—C.V.A. Jigs, Moulds and Tools Ltd., Portland Road, Hove 3. (17626)

"Mego-Meter", makers of? T.E.—These were made by the Electrical Equipment and Carbon Co. Ltd., but this firm went out of business in 1938. (17631)

Oil filled radiators, makers of? T.E.—Hurseal Ltd., 229 Regent Street, London W.1; Ocean Home Appliances Ltd., Temple Farm Works, Strood, Rochester, Kent; Habin Ltd., Dimplex Works, High Street, Totton, Hants. (17634)

"Washette" washing machine, makers of? S.E.E.—H. Fisher (Oldham), Ltd., Gloawick Road, Oldham. (17644)

Battery driven clocks, makers of? T.E.—Falkland Manufacturing Co., Ltd., 35 Sefton Street, Liverpool 8. (17649)

The above are selected from the questions we have answered this week. If you have a query, send it to us.

ANSWER WANTED

"Ross Comm" 3 kW elements for sterilisers, makers of?—N.W.E.B. (17639)

COMPANY REGISTRATIONS

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

A. Miller and Son, Ltd., 6 Dorset St., Baker St., W.1. Manufacturers of and dealers in domestic, household and general electrical and other equipment and appliances, etc. Cap.: £7,000. Dirs.: H. Miller, L. Gowler.

Wilsons (Wood Green) Ltd., British Railways Goods Depot, Station Rd., Wood Green, N.22. Electrical engineers and general electrical installation contractors, etc. Cap.: £5,000. Dir.: F. N. Wilson.

George Matthews and Co. (Cradley) Ltd., 11 Chapel St., Wall Heath, Brierley Hill. Manufacturers of and dealers in electrical, motor, mechanical and non-mechanical vehicles, etc. Cap.: £2,500. Dirs.: G. P. Matthews and Mrs. B. Matthews.

Marshalsea Hatch Ltd., 1 Powerscourt Rd., Portsmouth. Electrical and mechanical engineers, contractors, etc. Cap.: £1,000. Dirs.: Mrs. D. D. Parkhouse, C. H. Marshalsea, and G. H. Hatch.

TRADE MARK APPLICATIONS

This information is extracted from the Official Journal by permission of the Controller.

Consulation. 681,343. Class 9. Insulated electric wires, fuse wires, and electric cables. J. Day and Co. (Derby Works), Ltd., Harrow Manorway, Abbey Wood, London S.E.2.

Cutanit. 673,154. Class 9. Electrodes for electric welding, and electrical contacts. Cutanit, Ltd., 50 Gresham Street, London E.C.2.

Millionite. 680,865. Class 9. Insulated electric cables. Donal Aidan O'Duffy, 79 Biddulph Mansions, Maida Vale, London W.9.

Pluplanar. 683,372. Class 7. Chain pulley blocks, cranes, conveyors (machines) and overhead chain conveyors, all being electrically-operated. Geo. W. King, Ltd., Hartford Works, Walsworth Road, Hitchin, Herts.

Tiara. 667,851. Class 9. Radio and electrical fitting, all of metal. P. Tyralla, Ltd.; trading also as "Flit" Slider Fastener Co., 19 Clerkenwell Close, London E.C.1.

MEETINGS TO NOTE

THURSDAY, FEBRUARY 9

Inc. Plant Engrs. (Newcastle-on-Tyne).—"Approach to Industrial Lighting Problems," R. B. Wingate. Turks Head Hotel, Newcastle.—7.15 p.m.

I.E.S. (Cardiff centre).—"Lighting of Architecture," G. Grenfell Baines. S. Wales Electricity Board Demonstration Theatre, The Hayes, Cardiff.—5.45 p.m.

I.E.E. (Bristol students' section).—"Protective Systems in A.C. Networks," J. Gillians. Electricity House, Bristol.—7 p.m.

I.E.S. (Leicester centre).—"Transport Lighting," J. N. Hull. Demonstration Theatre, E. Midlands Electricity Board, Leicester sub-area, Charles Street, Leicester.—6.30 p.m.

E.P.E.A. (Northern Meter group).—"Some Westinghouse Power Supply Devices for Laboratory and Test Room Power Supplies," S. A. Stevens. Engineers' Club, Albert Square, Manchester.—7 p.m.

Exhibition of French Scientific Instruments.—Science Museum, South Kensington (Open until Feb. 26).

FRIDAY, FEBRUARY 10

A.S.E.E. (Bristol branch).—"Electric Arc Welding." J. H. Paterson. Grand Hotel, Broad Street, Bristol 1.—7.30 p.m.

E.P.E.A. (Southern Meter Engineers' group).—"Protective Gear: Design and Testing of Circuitry and Components," J. G. Welling. Caxton Hall, Westminster.—6.30 p.m.

I.E.S. (Birmingham centre).—"Lighting in Mines—with Special Reference to Flame Proof Equipment," F. W. Sharpley, Imperial Hotel, Temple Street, Birmingham.—6 p.m.

A.S.E.E. (Nottingham branch).—"Lumens, Lamps and Lighting," C. S. Caunt. G.E.C. Showroom, Stoney Street, Nottingham.—7.30 p.m.

SATURDAY, FEBRUARY 11

I.E.E. (N. Midland students). — "The Historical Development of the Induction Type Energy Meter," C. Adamson. Yorkshire Electricity Board Offices, Ferensway, Hull.—2.30 p.m.

MONDAY, FEBRUARY 13

I.E.E. (Western centre).—"Radar." R. A. Smith. Guildhall, Swansea.—6.30 p.m.

I.E.S. (Leeds centre).—"Street Lighting—Its Background." E. J. Stewart. Lighting Service Bureau, 24 Aire Street, Leeds 1.—6 p.m.

I.E.E.—"Interference Suppression." Discussion. Institution Buildings.—5.30 p.m.

TUESDAY, FEBRUARY 14

I.E.E. (Scottish centre).—"Generation and Flow of Harmonics in Transmission Systems." S. Whitehead and W. G. Radley. Institution of Engineers and Shipbuilders, 39 Elmbank Crescent, Glasgow C.2.—7 p.m.

Instn. Heating and Ventilating Engrs. (Cardiff meeting). "Electrode Boilers." J. C. Edwards. G.E.C. Buildings, Cardiff.—6.30 p.m.

I.E.S. (London meeting).—"The Dimming of Fluorescent Lamps and Its Application to the Theatre." J. W. Strange. Lighting Service Bureau, 2 Savoy Hill, W.C.2.—6 p.m.

A.S.E.E. (S. W. London branch).—"Practical Problems with M. I. Cables." G. E. D. Redman. Compton Hall, Compton Road, Wimbledon, S.W.19.—8.15 p.m.

WEDNESDAY, FEBRUARY 15

Inc. Plant Engrs. (Western branch).—"Choice, Operation and Maintenance of Electric Motors." J. Mitchell. Grand Hotel, Bristol.—7.15 p.m.

Inc. Plant Engrs. (London branch).—"Colour and Illuminations in Industry." K. R. Gibbons. Royal Society of Arts, John Adam Street, Adelphi, W.C.2.—7 p.m.

I.E.E. (Scottish centre).—"Generation and Flow of Harmonics in Transmission Systems." S. Whitehead and W. G. Radley. Heriot-Wall College, Edinburgh.—7 p.m.

I.E.S. (Swansea group).—"Lighting for Sports and Games." D. E. Beard. Y.M.C.A., Swansea.—6 p.m.

I.E.E. (Radio section).—"Ground-Wave Propagation Over an Inhomogeneous Smooth Earth. Experimental Evidence and Practical Implications." G. Millington and G. A. Insted, Institution Buildings.—5.30 p.m.

I.E.E. (Southern centre).—"The Recurrent-Surge Oscillograph and Its Application to the Study of Surge Phenomena in Transformers." E. L. White and W. Nethercot. Grand Hotel, Bournemouth.—6.30 p.m.

Assn. Mining Electrical and Mechanical Engrs. (W. Scotland branch).—"Some Aspects of the Electrification of Coal Preparation Plant." D. R. Love and G. D. Harrodine. Royal Technical College, Glasgow.—7 p.m.

A.S.E.E. (Coventry branch).— "The Use of Magnets in Industry Today." J. F. Cordwell. Technical College, The Butts, Coventry.—7 p.m.

A.S.E.E. (Manchester branch).—"Simple Vector Diagrams as Applied to Electrical Calculations." J. W. Fall. Engineers' Club, Albert Square, Manchester.—7.30 p.m.

THURSDAY, FEBRUARY 16

I.E.S. (Bradford group).—"The Development of Plastics for Lighting." P. H. Collins. Yorkshire Electricity Board, 45-53 Sunbridge Road, Bradford.—7.30 p.m.

The jointer's art

. . . . is founded on sound joint design and the use of the highest quality materials. Henley's are specialists in super-tension cable technique: manufacture, installation, jointing; write for super-tension booklets.

BY APPOINTMENT ELECTRIC CABLE MANUFACTURERS

MORE POWER FOR BARNES

Henley jointers show their craftsmanship on the 66kV. Gas Cushion Cables on the Wandsworth—Barnes route. This important contract, carried out by Henley's Contract Department, reinforces the existing B.E.A. 66kV. network.

Consulting Engineers:
Messrs. Merz and McLellan

HENLEY CABLES

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, LONDON, E.C.1

Power Converting Plant

The photograph shows a Metrovick Glass Bulb Mercury Arc Rectifier for a trolleybus sub-station in Pretoria, S.A.

MERCURY-ARC RECTIFIERS

Metrovick power conversion plant is in operation all over the world. The latest designs of Mercury Arc Rectifiers maintain the reputation gained many years ago for equipment covering complete conversion schemes for traction, chemicals, steel works, etc. Complete conversion equipments, including glass bulb and steel tank air-cooled pumpless or continuously evacuated type rectifiers, transformers and switchgear, are among the standard Metrovick products.

METROPOLITAN-VICKERS ELECTRICAL CO. LTD.

TRAFFORD PARK, MANCHESTER 17 C/A 906

CLASSIFIED ADVERTISEMENTS

Official Tenders and Appointments · Situations Vacant · For Sale · Wanted

TENDERS INVITED

COUNTY BOROUGH OF BURNLEY

EXTENSIONS TO TOWNELEY TECHNICAL HIGH SCHOOL

ELECTRICAL INSTALLATION

TENDERS are invited for the work involved in the electrical installation to the extensions to the Towneley Technical High School for Boys at Burnley.

Specification and Form of Tender may be obtained on application to the Borough Engineer, Town Hall, Burnley, on payment of a deposit of £1 1s. which will be returned on receipt of a bona-fide tender.

Tenders must be received by the Town Clerk not later than 9 a.m. on Friday, February 24, 1950.

The Corporation does not bind itself to accept the lowest or any tender.

C. V. THORNLEY,
Town Clerk.

Town Hall, Burnley.
January, 1950. (D 576)

APPOINTMENTS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50 inclusive, or a woman between the ages of 18 and 40 inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1947, or the vacancy is for employment excepted from the provisions of that Order.

NORTH WESTERN ELECTRICITY BOARD

No. 1 Sub-Area

APPOINTMENT OF JUNIOR DRAUGHTSMEN

APPLICATIONS are invited for appointments as Junior Draughtsmen in the Building Section of No. 1 Sub-Area (Manchester).

Candidates should hold the ordinary National Certificate in Building and have had practical experience in the specification, design and erection of substations, stores, offices or similar buildings.

Previous experience in an electricity undertaking is desirable but not essential.

The provisional salary, which is subject to negotiation by the appropriate bodies, will be within the range £75-£388 per annum, depending upon age and experience.

Applications, stating age, training and experience, present position and salary should be received by the Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester, 8, not later than February 25, 1950. (D 596)

BRITISH ELECTRICITY AUTHORITY

South Western Division

SYSTEM OPERATION DEPARTMENT—DIVISIONAL HEADQUARTERS

APPLICATIONS are invited for the appointment of a GENERAL ASSISTANT ENGINEER in the System Operation Department at Divisional Headquarters, Bristol.

The duties are of a general technical and statistical nature in connection with Power Station Operation and will include some shift duties in the Grid Control Room.

Applicants should have had a good general and technical education. Preference will be given to candidates who are Graduates of the I.E.E. or who hold equivalent qualifications. Experience in a Power Station will be an advantage.

The salary will be within the range £392 8s. to £523 13s., which range is provisional and subject to negotiation by the appropriate bodies.

The appointment will be subject to superannuation under terms and conditions approved by the British Electricity Authority.

Applications, stating age, full details with relevant dates of general education and technical training and experience, qualifications, present position and salary, should be addressed to the Divisional Secretary, British Electricity Authority, South Western Division, British Electricity House, 26 Oakfield Road, Bristol 8.

The closing date for receipt of applications is February 18, 1950.

R. C. BARRETT,
Divisional Secretary.

February 1, 1950. (D 563)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

Lothians Sub-Area
Musselburgh

APPLICATIONS are invited for the post of CONSTRUCTION ENGINEER. Applicants should possess technical qualifications stipulated for admittance to the Institution of Electrical Engineers and have gained wide experience in distribution practice, including the design and construction of overhead lines; the laying and jointing of underground cable and the installation of services; and the erection and commissioning of static substations on systems operating on voltages up to and including 33 kV.

The salary for the post is provisionally fixed at Class "C," Grade 5 (£617 per annum) and is subject to adjustment upon the adoption of a nationally negotiated scale. The post is superannuable.

Applications, giving full details of training, qualifications, experience, age, present appointment and salary, should be submitted to the Manager, Lothians Sub-Area, South-East Scotland Electricity Board, Musselburgh, within 14 days of the appearance of this advertisement. (D 573)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

CONTROL ENGINEER, COVENTRY

APPLICATIONS are invited from suitably qualified Engineers for the position of Control Engineer, at Longford Generating Station, Coventry.

The salary and conditions of service will be in accordance with the N.J.B. Schedule, Class "J," Grade 9a.

Applicants should have experience in the operation of a power station switchboard and be fully conversant with high tension switching operations and protective systems.

Forms of application, which may be obtained from the Divisional Establishments Officer, British Electricity House, Barker Gate, Nottingham, should be returned not later than February 17, 1950.

W. S. BURGE,
Divisional Controller.

British Electricity House,
Barker Gate, Nottingham. (D 535)

NORTH WESTERN ELECTRICITY BOARD

No. 2 Sub-Area

APPOINTMENT OF DRAUGHTSMEN
SUB-AREA HEADQUARTERS

APPLICATIONS are invited for the following positions on the staff of the drawing office at the headquarters of the No. 2 Sub-Area, which are at present in Manchester, later to be at Bolton:—

SENIOR DRAUGHTSMEN. Provisional salary and conditions within the Board's scale of £525-£625 per annum.

ENGINEERING DRAUGHTSMEN. Provisional salary and conditions within the Board's scale of £400-£500 per annum.

JUNIOR DRAUGHTSMEN AND TRACERS. Provisional salary and conditions within the Board's Scale of £75-£388 per annum.

PHOTOPRINT ASSISTANTS. Provisional salary appropriate to age in accordance with the Interim General Clerical Scale, i.e. £135-£385 per annum.

These salaries are provisional and are subject to negotiation with the appropriate body. The posts are superannuable.

Applicants must have had a good general and technical education and training and preferably hold an ordinary National Certificate in electrical or mechanical engineering. They should be neat and expeditious draughtsmen with experience in connection with electrical diagrams and design, lay-out and construction of substations, distribution systems, switchgear, protective gear, control circuits, and mains records. A knowledge of overhead construction and details of pole fittings and the preparation of plans for wayleaves, notices, etc., is also required.

Applicants for the positions of Photoprint Assistants must have had experience, preferably with a printing firm, and be competent to produce prints by Ferro, Dyeline, or True to Scale processes, and have knowledge and practical experience of Photostat or Barcograph machines.

Applications specifying appointment for which application is made, stating age, details of education, qualifications and experience, present position and salary, should be received by the Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester 8, not later than Saturday, February 25, 1950. (D 594)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

APPLICATIONS are invited for the position of ASSISTANT ENGINEER (Transmission). The successful applicant will be located in Edinburgh, but the work will entail travelling over the area covered by the Board's main transmission system. The latter is expanding very rapidly and the further prospects of the position are accordingly good.

Applicants should have received sound training as electrical engineers, and have attained the Higher National Certificate or have passed the Graduate Examination of the I.E.E.

Experience should include construction, testing and maintenance of 132 kV switchgear, transformers, overhead lines and ancillary substation equipment.

The commencing salary will be related to the experience and qualifications of the applicant but will be not less than £700 per annum and will be subject to adjustment by the appropriate negotiating machinery.

The successful applicant will require to contribute to the Board's Superannuation Scheme and pass a medical examination.

Application form, obtainable from The Secretary, 16 Rothesay Terrace, Edinburgh 3, must be returned within 21 days from the publication of this notice.

January 30, 1950. (D 559)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ASSISTANT MECHANICAL MAINTENANCE ENGINEER LONGFORD GENERATING STATION

APPLICATIONS are invited from suitably qualified engineers for the post of Assistant Mechanical Maintenance Engineer at Longford Generating Station, Coventry.

Candidates should have a sound engineering training and be thoroughly conversant with repairs and maintenance of a large generating station.

Commencing salary in accordance with Class "J," Grade 8 of the National Joint Board Schedule, at present £562 rising to £586 per annum. The appointment will be superannuable under terms and conditions of the British Electricity Authority's Superannuation Scheme.

Applications to be submitted on forms obtainable from the Divisional Establishments Officer at the undermentioned address and when completed to be returned not later than February 24, 1950.

W. S. BURGE,
Divisional Controller.

British Electricity Authority,
British Electricity House, Barker Gate, Nottingham.
(D 570)

NORTH WESTERN ELECTRICITY BOARD

No. 2 Sub-Area

APPOINTMENT OF ASSISTANT OPERATION AND MAINTENANCE ENGINEER AND ASSISTANT ENGINEERS

APPLICATIONS are invited for the following posts on the Engineering Staff of the No. 2 Sub-Area:—

SENIOR ASSISTANT OPERATION AND MAINTENANCE ENGINEER. Salary and conditions within the range of the Board's scale, i.e. £750-£800 per annum.

ASSISTANT OPERATION AND MAINTENANCE ENGINEERS. Salary and conditions within the range of the Board's Scale, i.e. £650-£750 per annum.

ASSISTANT ENGINEERS (OPERATION AND MAINTENANCE). Salary and conditions within the range of the Board's scales, i.e. £400-£625 per annum.

Applicants must have had experience in the operation and maintenance of large industrial and rural distribution systems incorporating overhead lines, underground cables and substations operating at voltages up to and including 33 kV; high voltage testing and fault localising; lay-out and operation of control stations. Successful candidates will be required to undertake standby duties.

ASSISTANT ENGINEERS (CONSTRUCTION). Salary and conditions within the range of the Board's scale, i.e. £400-£700 per annum.

Applicants must have had experience in planning, construction, and operation of large industrial and rural networks including overhead lines and underground cables at voltages up to and including 33 kV; survey and levels for overhead construction; control lay-out operation; estimating for and supervising construction work of such networks and substations, etc.; assembly and installation of switchgear, transformers, controls and associated equipment in substations.

Salaries, which are provisional and subject to negotiation by the appropriate bodies, will be within the ranges stated according to qualifications and experience. The posts are superannuable.

Preference will be given to applicants who are corporate or graduate Members of the Institution of Electrical Engineers or who hold equivalent qualifications.

Applications, stating age, education, qualifications and experience, present position and salary, should be received by the Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester 8, not later than Saturday, February 25, 1950. (D 595)

NORTH WESTERN ELECTRICITY BOARD

No. 6 Sub-Area

APPOINTMENT OF SENIOR ASSISTANT DISTRICT ENGINEER, CARLISLE DISTRICT

APPLICATIONS are invited for the position of Senior Assistant District Engineer in the Carlisle District of the No. 6 Sub-Area.

The duties of the post will be to assist the District Engineer generally in the construction, operation and maintenance of underground cables, overhead lines and sub-stations and the routine work of a district mains office.

Preference will be given to applicants who are graduates of the Institute of Electrical Engineers or who hold exempting qualifications.

The provisional salary for the post will be in accordance with the National Joint Board Schedule, Class "G," Grade 5, i.e. £617-£633-£649 per annum.

Applications, stating age, qualifications and experience, present position and salary, should be received by the Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester 8, not later than Saturday, February 25, 1950. (D 602)

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRIBUTION ENGINEER, Sevenoaks District. Provisional salary £391 per annum under N.J.B. Class "F," Grade 9. Superannuation will be arranged. Applicants should be experienced in the maintenance and operation of single and three-phase e.h.v., h.v., and l.v. underground and overhead systems and substations, and should preferably hold the Higher National Certificate or equivalent qualification in electrical engineering.

Applications, giving two referees, must reach H. F. Gill, Esq., Sevenoaks and Horley Manager, South Eastern Electricity Board, Electric House, West Hill, Oxted, Surrey, by February 20, 1950.

A. L. BURNELL,
Secretary.

February, 1950. (D 583)

EASTERN ELECTRICITY BOARD

Northmet Sub-Area

APPOINTMENT OF ENGINEERING ASSISTANT, PLANNING AND DEVELOPMENT SECTION, NORTHMET SUB-AREA HEADQUARTERS (Ref. No. 229)

APPLICATIONS are invited for the appointment of an Engineering Assistant in the Planning and Development Section at Northmet House, Cannon Hill, Southgate, N.14. Applicants should be Corporate Members of the Institution of Electrical Engineers, or possess equivalent qualifications, and should have had experience in the planning and development of systems from low voltage up to 33 kV involving overhead lines and underground cable networks with associated substations. A knowledge of public lighting engineering would be an advantage.

The provisional salary for this appointment will be £600 per annum. The salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a superannuation scheme and may be required to pass a medical examination.

Applications should be made on forms obtainable from: The Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Cannon Hill, Southgate, N.14, to whom completed application forms should be returned by February 24, 1950. (D 591)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment:—

SHIFT CHARGE ENGINEER—Bedford Generating Station. Salary in accordance with N.J.B. Schedule, Grade 8, Class "H" (£520-£547 per annum).

Applicants should have served an apprenticeship and obtained a Higher National Certificate in Electrical and/or Mechanical Engineering or equivalent and possess experience in the operation of power stations. Experience in the operation of plant at high steam pressure will be an advantage.

The salary is in accordance with the scale at present operating but may be subject to negotiation through the medium of the Joint Board.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards' superannuation scheme.

Applications, stating age, experience and present position should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than February 24, 1950. Envelopes should be endorsed "Shift Charge Engineer, Bedford."

W. N. C. CLINCH,
Controller.

Northmet House, Southgate, N.14. (D 597)

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following positions at Fulham Generating Station:—

ELECTRICAL TESTERS (2)

The duties of the position include the testing of electrical equipment in a large modern Power Station. Technical education up to Higher National Certificate standard in electrical engineering is required together with an Engineering Apprenticeship followed by experience of electrical testing.

Salary in accordance with N.J.B. Schedule, Class "M," Grade 9a.

JUNIOR TECHNICAL ENGINEER FOR EFFICIENCY DEPARTMENT

Candidates should have some Power Station experience, including operating experience, together with a general engineering training. Technical education should be at least up to Ordinary National Certificate standard.

Salary in accordance with N.J.B. Schedule, Class "M," Grade 10a.

Applications for the foregoing vacancies stating age, qualifications and experience, should be addressed to the Acting Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, to be received within 14 days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(D 574)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment :—

SHIFT ENGINEER—Little Barford Generating Station.

Salary in accordance with N.J.B. Schedule, Grade 8a, Class " J " (£526-£551 per annum).

Applicants should have served an apprenticeship and obtained an Ordinary National Certificate in Electrical and/or Mechanical Engineering or equivalent and possess experience in the operation of power stations. Experience in the operation of plant at high steam pressure will be an advantage.

The salary is in accordance with the scale at present operating, but may be subject to negotiation through the medium of the Joint Board.

The appointment will be Superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, experience and present position, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than February 18, 1950. Envelopes should be endorsed " Shift Engineer, Little Barford."

W. N. C. CLINCH,
Controller.
Northmet House, Southgate, N.14. (D 530)

BRITISH ELECTRICITY AUTHORITY

South Western Division

TRANSMISSION DEPARTMENT VACANCIES—DIVISIONAL HEADQUARTERS

APPLICATIONS are invited for the following appointments in the Transmission Department at Divisional Headquarters, Bristol:

(a) SECOND ASSISTANT ENGINEER. Salary range £707 8s. to £838 13s. per annum.

(b) GENERAL ASSISTANT ENGINEER. Salary range £392 8s. to £523 13s. per annum.

Salaries for both appointments will be provisional and subject to negotiation with the appropriate organisations.

Applicants for (a) should be corporate members of the Institution of Electrical Engineers or hold equivalent qualifications and should have experience in the erection and maintenance of high voltage transmission lines, transformers, switchgear, etc.

Applicants for (b) should possess Higher National Certificate in Electrical Engineering or be graduate members of the Institution of Electrical Engineers. Preference will be given to candidates with a knowledge of the maintenance and operation of a high voltage system. A works training on high voltage switchgear and transformers will be considered an advantage.

The appointments will be subject to superannuation under the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, qualifications, experience, present appointment and salary should be addressed to the Divisional Secretary, British Electricity Authority, South Western Division, British Electricity House, 26 Oakfield Road, Bristol 8, so as to be received not later than February 20, 1950.

R. C. BARRETT,
Divisional Secretary.
January 24, 1950. (D 558)

BOROUGH OF WILLESDEN

APPOINTMENT OF ELECTRICAL ENGINEERING ASSISTANT

THE Council invite applications for the appointment of an Electrical Engineering Assistant on the permanent staff of the Borough Engineer and Surveyor's Department. The salary attaching to the post will be Administrative, Professional and Technical Grade III of the National Whitley Council Scale for the London Area, namely £450 per annum rising by £15 per annum to £495 per annum plus London Weighting according to age.

Candidates for the appointment must possess one or more of the following qualifications, namely the Higher National Certificate in Electrical Engineering, the Joint Section A examination of the Institution of Civil Engineers and the Institution of Electrical Engineers and in addition have some training and practical experience on general installation and maintenance of electrical engineering work.

The appointment, which will be terminable by one month's notice on either side, is subject to the provisions of the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

Applications, giving age, experience, etc., accompanied by copies of not more than three testimonials, should be addressed to the undersigned, endorsed "Electrical Engineering Assistant," not later than 10 a.m. on Friday, February 24.

It will be necessary for the successful candidate to provide his own housing accommodation as the Council is not in a position to assist.

Canvassing, directly or indirectly, will be deemed a disqualification.

R. S. FORSTER,
Town Clerk.

Town Hall, Dyne Road, Kilburn, N.W.6.
January 26, 1950. (D 567)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

SHIFT CHARGE ENGINEER

ST. SWITHIN'S GENERATING STATION, LINCOLN

APPLICATIONS are invited for the position of Shift Charge Engineer at St. Swithin's Generating Station, Lincoln.

Applicants should have had sound technical training and practical experience in the operation and control of steam generating plant and switchgear, and preference will be given to candidates who have the Higher National Certificate or its equivalent.

The salary is in accordance with Class "H," Grade 8 of the present National Joint Board Schedule, and the applicant will be superannuable under terms and conditions approved by the British Electricity Authority.

Official forms of application which are obtainable from the Divisional Establishments Officer, British Electricity Authority, British Electricity House, Barker Gate, Nottingham, should be delivered to the undersigned not later than February 24, 1950.

W. S. BURGE,
Divisional Controller.

British Electricity Authority,
British Electricity House, Barker Gate, Nottingham.
(D 560)

ARMATURE and Stator Winders required. Only those with first-class experience need apply. E.T.U. rates of pay plus efficiency bonus Good prospects of promotion. —Eaton Electrical Co. (Woolwich) Ltd., Lakedale Road, S.E.18. (D 606)

ASSISTANT required for electrical wholesalers' trade counter. Good wages. Profit-sharing scheme in operation.—Apply, Gibbs and Dandy, Ltd., 34 George Street, Luton. (D 500)

ASSISTANT DISTRIBUTION ENGINEER, age 25-30, for public utility concern in the Far East. Must have had practical experience in erection and maintenance of high and low tension systems, cable laying and jointing, static substation plant and switchgear. Good salary, with free quarters, electricity, fuel and medical attention. Progressive position for experienced and capable man.—Apply, stating full details of past experience and when available, to Box ET367, L.P.E., 110 St. Martin's Lane, W.C.2. (D 580)

BRITISH INSULATED CALLENDER'S CABLES LTD. have vacancies for SENIOR DRAUGHTSMEN for electric traction work—crane equipment—overhead line, outdoor switches. Permanent positions. Superannuation scheme. Salary in accordance with qualifications and experience.—Apply, in writing, to Staff Officer, B.I.C.C. Ltd., Prescot, Lancs. (D 566)

CHIEF DRAUGHTSMAN required to control office for transformers up to 5,000 kVA.—Apply, giving age, experience, and salary required to Box No. 1791, Electrical Times. (D 499)

DRAUGHTSMAN required by manufacturers of industrial electric cooking and heating equipment. Midlands. Age, experience and salary required.—Box No. 1833, Electrical Times. (D 604)

ELECTRICIAN WIREMAN required; experienced all systems.—Apply, in writing, Giffords, Basingstoke. (D 496)

ELECTRICAL DESIGNER required for the F.H.P. Motor Laboratory of a large light electrical engineering company in the West London area. Applicants should have a sound technical and practical training, with initiative to accept full responsibility of a project from the initial design stage to factory production. Excellent prospects if qualifications and experience are suitable.—Apply, giving details of age, education and job history to Box No. 1829, Electrical Times. (D 589)

ELECTRICAL ENGINEER SURVEYOR required for Midlands area. Progressive position. Applicants should have practical training in winding, installation and maintenance of electrical plant. Theoretical training to Higher National Certificate standard. Age 25-33.

Reply, giving full particulars to Chief Engineer, Cornhill Insurance Co., Ltd., Shalford House, Guildford, Surrey. (D 590)

ENGINEER required by well-known makers of water tube boilers for position of ASSISTANT OUTSIDE MANAGER involving regular visits to power stations, etc. Qualifications, sound technical knowledge, good education, experience in erection. Preferably resident London area.—Write, stating age, experience and salary required to Box G840, c/o Streets, 110 Old Broad Street, E.C.2. (D 600)

ENGLISH ELECTRIC require for their Acton Drawing Office, ELECTRICAL AND MECHANICAL DESIGN DRAUGHTSMAN for interesting work covering heavy electrical switchgear. Applicants should have a sound D.O. experience of switchgear work and preference will be given to those possessing the Higher National Certificate. Write, giving full details, quoting Ref. 112 to Central Personnel Services, English Electric Co., Ltd., 24 Gillingham Street, Westminster, S.W.1. (D 580)

EXPORT merchants require ASSISTANT for Manchester electrical dept. Good technical knowledge of plant, switchgear and accessories. Preferably someone with Higher National Certificate and some commercial experience. Age 27-33. State age and salary required.—Box No. 1815, Electrical Times. (D 561)

JOINTER, Class I, required at Minehead, Somerset. Wages and conditions of service in accordance with N.J.I.C. Agreement.

Detailed applications to be sent to L. V. Turner, Sub-Area Manager, Taunton and West Somerset Sub-Area, South Western Electricity Board, The Parade, Taunton, within 7 days. (D 592)

JUNIOR DRAUGHTSMAN required for detail and assembly drawing, modifications and schedule preparation for manufacturers of electro-mechanical devices in West London area.—Write full details of experience and salary requ ired to Box No. 1827, Electrical Times. (D 585)

JUNIOR SALES ENGINEER required by instrument manufacturers in N.W. London, to deal, primarily, with exports. H.N.C. (Electrical Engineering) and practical experience in application of instruments desirable.—Apply, stating full details and salary required, to Box No. 1819, Electrical Times. (D 567)

LABORATORY ASSISTANT with experience in connection with meters, time switches and allied subjects. Higher National Certificate or Grad. I.E.E. Standard. Salary in accordance with experience and qualifications.—Write, giving full details to: Box No. 1803, Electrical Times. (D 532)

PLANNING ENGINEER with experience of electrical precision engineering required by manufacturers of time switches and meters. Write, giving full particulars of experience and qualifications. Salary in accordance with ability.—Box No. 1805, Electrical Times. (D 533)

J. W. WOOLLEY & CO. LTD.

A REPRESENTATIVE, preferably having contacts with farmers and to some extent with agricultural implement dealers, is wanted by J. W. Woolley and Co., Ltd., of Tamworth for each of the following Board Areas:—

(1) Eastern (especially Eastern Counties),
(2) North West (especially Lancashire),
(3) Mersey and N. Wales (especially Cheshire),
(4) South Eastern.

Only those with first-class credentials who have an enthusiasm for work of this sort and who are capable of taking on increased responsibility later need apply.

All replies, which will be treated in confidence, to be sent to J. W. Woolley, Parkfield House, Two Gates, Tamworth, Staffs. Testimonials or other supporting documents should not be sent in the first instance, but the applicant should include details of education, all positions held since leaving school, the extent of his knowledge of:

(a) Woolley Sterilising Equipment, and
(b) Alfa-Laval, Fullwood, Gascoigne and Simplex Milking Equipment,

and the remuneration required.

Envelopes to be marked "Personal/1", 2, 3 or 4 as the case may be, in the top left hand corner. (D 538p)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

LIGHTING DESIGN ENGINEER to prepare fluorescent and other lighting schemes in London office of electrical manufacturers. Nat. Cert. E.E. Lighting training and experience necessary, I.E.S. member preferred. British National about 30.—Please give full information to: Box No. 1793, Electrical Times. (D 506)

OVERHEAD LINE ENGINEER required for layout and site supervision of construction on rural distribution schemes in North of Scotland. Should have previous experience of wood pole construction. Graduate preferred.—Apply, in writing, to Kennedy and Donkin, 32 Alva Street, Edinburgh, 2. (D 599)

PAPER CABLE ESTIMATOR, preferably with experience of foreign specifications required.—Full particulars to Aberdare Cables, Ltd., Aberdare, Glamorgan. (D 438)

PRODUCTION MANAGER required for light engineering manufacturers in South Bedfordshire. Must be fully acquainted with up-to-date methods of Production Control and have sound engineering background covering mass production experience in large press shop and sheet metal fabrication and finishing. Applications, which will be treated with strict confidence, can only be considered from applicants who have held a similar position and who have been accustomed to full responsibility.—Write, stating age, present salary and full details of education and positions held, together with personal references, to Box No. 1825, Electrical Times. (D 584)

REPRESENTATIVES required for London and Home Counties. Knowledge of V.I.R. cables essential. Applicants having connection with contractors and industrial users will receive preference. Own car an advantage.—Write, stating age, experience and salary required, to The Associate Director of Home Sales, Enfield Cables Ltd., Victoria House, Southampton Row, London W.C.1. (D 572)

REQUIRED immediately, capable ESTIMATOR for paper cable manufacturing company in the Home Counties. Good salary and prospects. Excellent canteen available. Applications treated in the strictest confidence.—Box No. 1593, Electrical Times. (C 786)

SALES ENGINEER required for London and Home Counties. Must be conversant with all types of cables, boxes, etc. Preference given to applicant with car, and live connection.—Write, stating age, experience and salary required, to the Associate Director of Home Sales, Enfield Cables Ltd., Victoria House, Southampton Row, London W.C.1. (D 571)

SALES ENGINEER. Excellent opportunity offered by large electrical company to keen Sales Engineer with experience of electronic instruments for industrial use. Applicants must have actual experience of instrument sales and sound technical training. The successful candidate will operate from Head Office in London and cover the whole of the United Kingdom. As this is a new section being developed by the company concerned, there are good prospects for future advancement. Write, stating education, training, qualifications, positions held and salary earned to Box No. 1831, Electrical Times. (D 603)

APPOINTMENTS WANTED

BREAKDOWN ELECTRICIAN seeks situation: 15 years' experience fault location and repair of all types electrical plant, drive; travel anywhere. Resident North London.—Box No. 1757, Electrical Times. (D 432)

ELECTRICAL INSPECTOR (42), recently returned from Asia, seeks situation either in U.K. or overseas. Wide experience of construction and maintenance with various types of installations, both industrial and domestic.—Box No. 1789, Electrical Times. (D 495)

ELECTRONICS CONSULTANT seeks post anywhere in South America.—Box No. 1811, Electrical Times. (D 551)

KEEN London Graduate, 23, all-round manufacturing and power station experience, wants progressive, good position or agency in Indian branch of a British firm, or in Indian firm.—Box No. 1771, Electrical Times. (D 455)

REPRESENTATIVE, with own car, desires Agency for accessories, cables, fittings, switchgear, etc. Commission basis. 25 years' personal connection with Factors in Lancs. and Cheshire. Valuable contacts Elec. Boards.—Box No. 1813, Electrical Times. (D 555)

WORK WANTED

A MODERN factory gives quick service to your A.C. Induction MOTOR REPAIRS, with twelve months' guarantee on all replaced parts.—Brook Motors Ltd., Repairs Dept., No. 8 Works, Huddersfield. (C 76)

A.C. and d.c. ELECTRIC MOTOR REWINDS AND REPAIRS. Prompt service, fully guaranteed. Phone: EDGware 8631 (4 lines).—Service Electric Co., Ltd., Stanmore, Middx. (D 324)

ARMATURE ROTOR AND STATOR WINDING. We specialise in the repair and rewind of all types of electrical machines from fractional h.p. upwards. Special departments for vacuum cleaners, dryers, portable tools, etc. All work fully guaranteed.—Walter Crane, Greencoat Electrical Works, Westgate, Wakefield. Telephone 2172. (A 4)

CASTINGS, Fisher Foundries, Ltd., Greet, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B'ham, Victoria 0197. (D 330)

COIL WINDING and SMALL TRANSFORMERS, to any specification. Coils and transformers rewound.—Avon Transformer Co., 20 Heath Terrace, Leamington Spa(C774)

SMALL progressive firm desires contract work, ARMATURE AND STATOR WINDING, ASSEMBLY, TURNING considered. Competitive prices; high-class workmanship guaranteed.—Box No. 1729, Electrical Times. (D 379)

ZEROS REFRIGERATORS.—Complete range of repair and service now available. Equipment reconditioned to conform to pre-war manufacturers' specifications.—Time Engineers, Refrigeration Specialists, 60 Southend Road, Rainham, Essex. Tel.: Rainham 2358: or Southern Area Agency. Tel.: Springpark 4217. Electrical Spares supplied to the trade. (A 630)

WANTED

A.C./D.C. MOTORS, STARTERS, complete change-over installations, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. 'Phone: Chiswick 5105. (A 20)

ONE Variable Speed COMMUTATOR MOTOR, 400 V 3 phase, 50 cycles, 25-75 h.p. 330-990 r.p.m. or near offer.—Box No. 1823, Electrical Times. (D 582)

WANTED.—D.C. and a.c. ball-bearing MOTORS.—Full details to Britannia Manufacturing Co., Ltd., 22/26 Britannia Walk, London N.1. (A 13)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper, Ltd., 176 Brady St., Bethnal Green, E.1. (A 1)

WANTED, ROTARY CONVERTERS, any size.—Universal, 221 City Road, London, E.C.1. (A 16)

WANTED.—Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock Water-tube Boilers. Best prices paid. Prepared to purchase Babcock and Wilcox Water-tube Boilers for dismantling.—Apply, giving full details, to Midland Iron and Hardware Co., Cradley Heath. (A 5)

AGENCIES

MANUFACTURERS AGENTS' ASSOCIATION, INC. (E.T), 6 Bream's Buildings, London W.C.2, supplies free lists of Agents to Manufacturers seeking representation in important industrial centres. Membership available to established agents only. Particulars supplied. (A 7)

FOR SALE

CABLES & WIRE

ENAMELLED AND INSULATED COPPER WIRE, first makes only, gauges from 10-44 ex-stock, well below today's prices.—Alreco, The Almex Recovery and Refining Co., Ltd., 1-3 Robert Street, W.C.2. TEMple Bar 0902. (D 60)

PAPER INSULATED ARMOURED CABLES to BSS 480/1942. Considerable stocks available.—Cable Jointers, Ltd., 49 Avenue Road, W.3. Acorn 4831/2. (D 319)

PAPER insulated lead covered and armoured POWER CABLE to B.S.S. 480/1942, 660 V. Unused and manufactured by the best makers. At the following bargain prices. All drums of 500 yds. each.

0·15	4-core P.I.L.C. and S.	£325 per drum
0·1	4-core P.I.L.C. and S.	£305 .. ..
0·04	4-core P.I.L.C.S.W.A. and S.	£206 .. ..
0·0225	4-core P.I.L.C.S.W.A. and S.	£155 .. ..

Write for full details to Messrs. Lipton Products, Ltd., Phoenix Works, Lamprell Street, Bow, E.3. (D 305)

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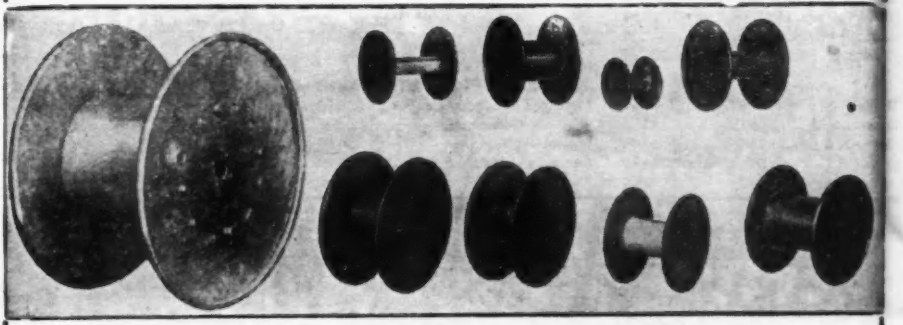

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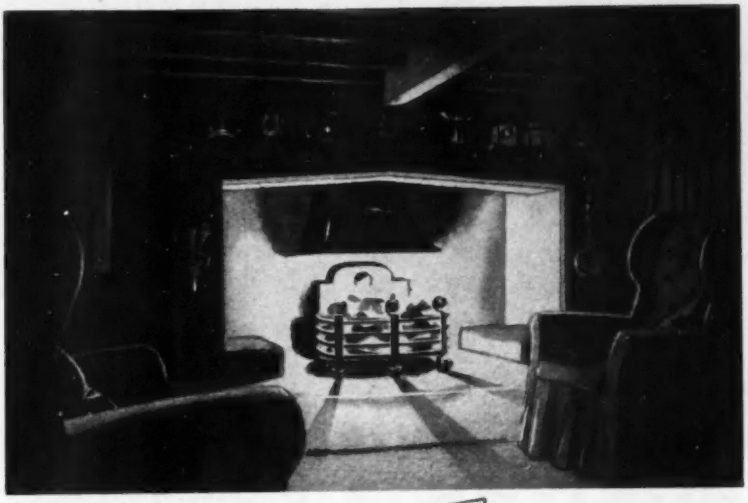

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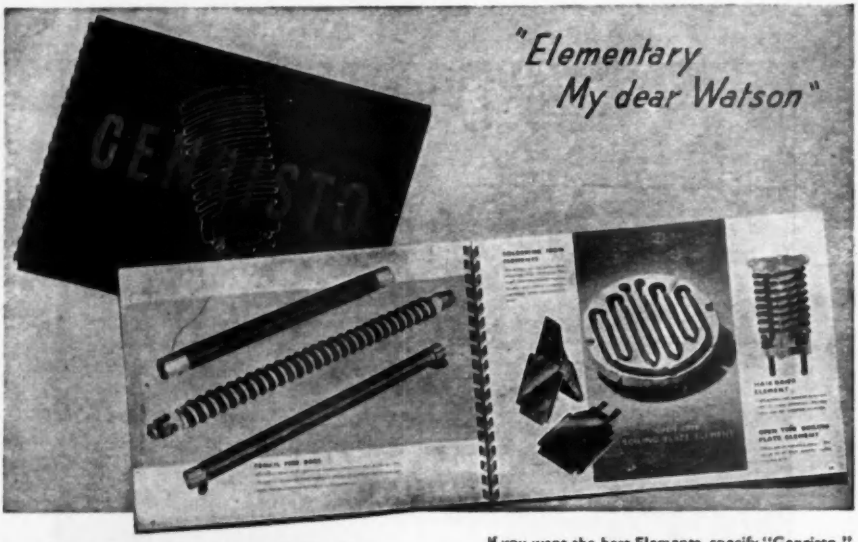

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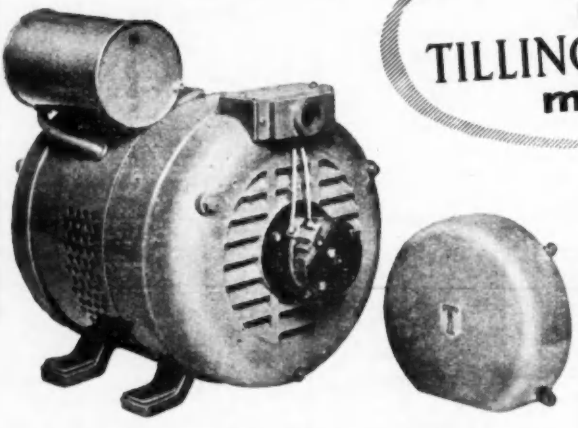

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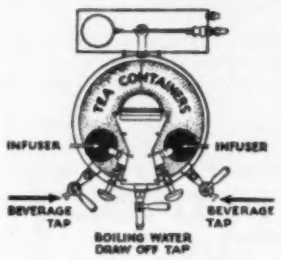

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The secret is water—always freshly boiled. 'Teatomaton' makes twenty gallons of tea in twenty-five minutes, the whole operation taking place within one outer case, which is strongly built and finely finished in Burnished Copper or chromium-plated. This incorporates a Jackson Boiler, divided container, and two tea infusers (see diagram). A draw-off tap supplies constant boiling water for making separate pots of tea or any other purpose.

The divided container, free from crevices, is easily cleaned and the Tea Infusers are specially constructed to stand up to rough treatment. Available in four sizes (5, 10, 15 or 20 gallon capacity), and constructed for use in hard or soft water districts. May we send you full details or arrange a demonstration.

The Jackson 'Care and Maintenance Service' is increasingly popular and an invaluable safeguard. Full information gladly supplied. Terms on request.

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WEATHERPROOF METAL-CLAD PLUGS, SOCKETS SWITCH PLUGS, ETC. for all electrical purposes

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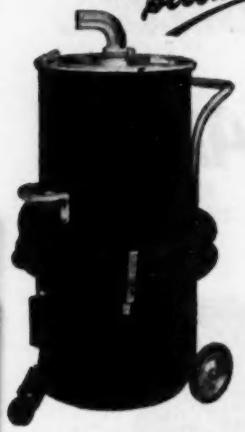

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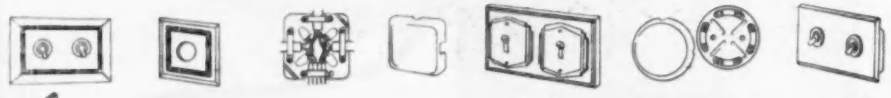
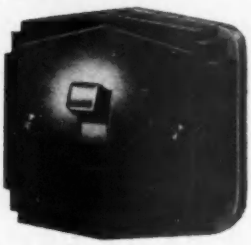


Tenby Pilot Switch



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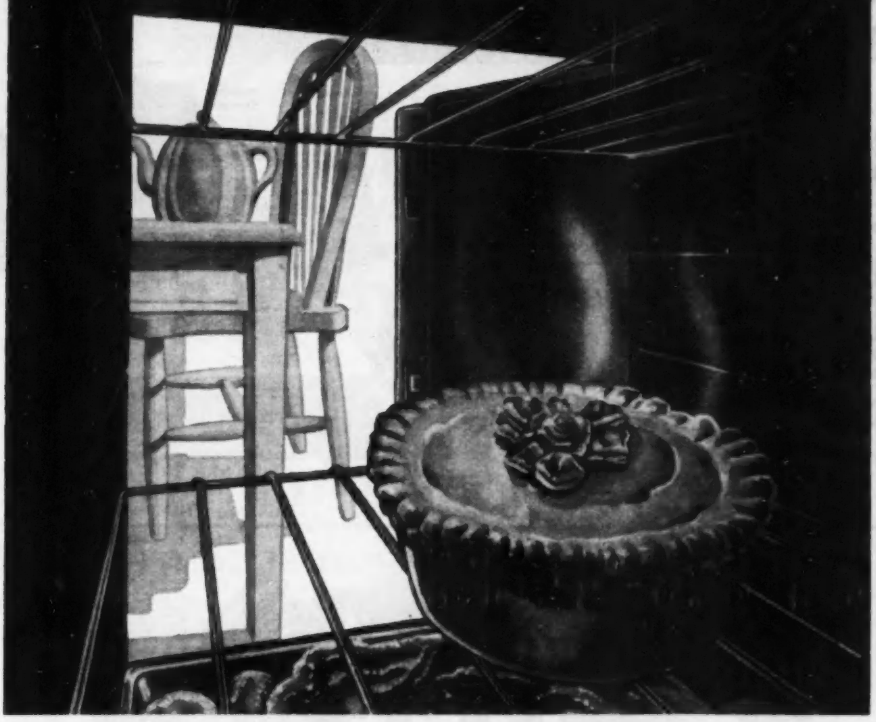
Inside this oven...



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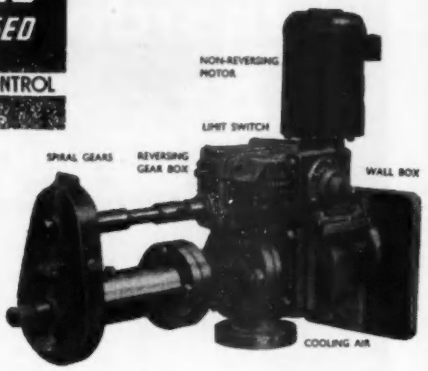

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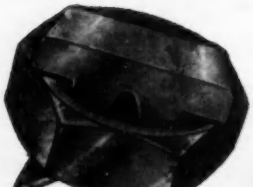

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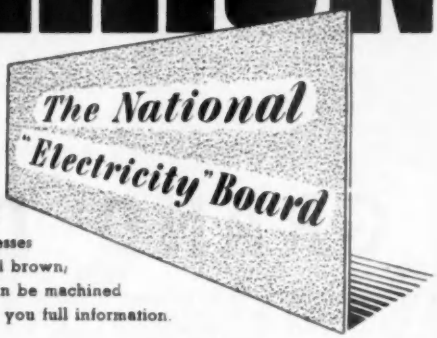

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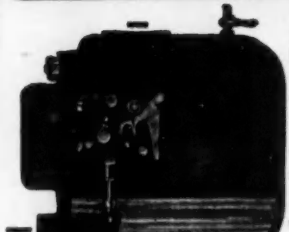

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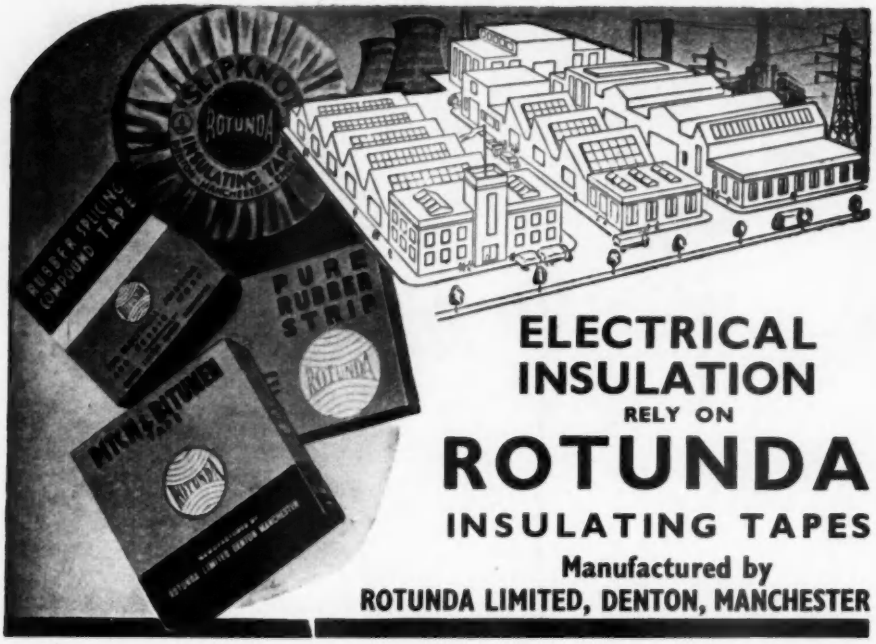

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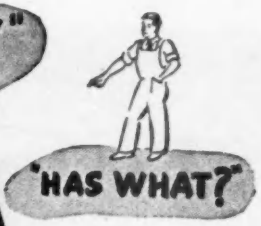

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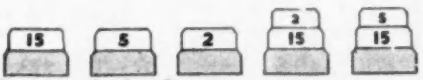

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From the *EVENING NEWS*
December 14th, 1949

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Why They Still Shine

Londoners who suffered the inconvenience of power cuts early to-day were puzzled when, in bright sunshine, they saw street lights still on. Last night's power cuts were responsible. The lights are controlled by time switches, which, when the power is cut, stop working. When the power is restored the clocks have lost time equivalent to the period of the cut.

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When daylight fails, the ELLIOTT photo-electric control automatically switches the lights ON

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The ELLIOTT Controller ensures absolutely reliable trouble-free lighting control, even after power cuts. Fully automatic, requires no resetting, and no routine maintenance. Especially valuable for traffic signs on isolated sites and for factory lighting.

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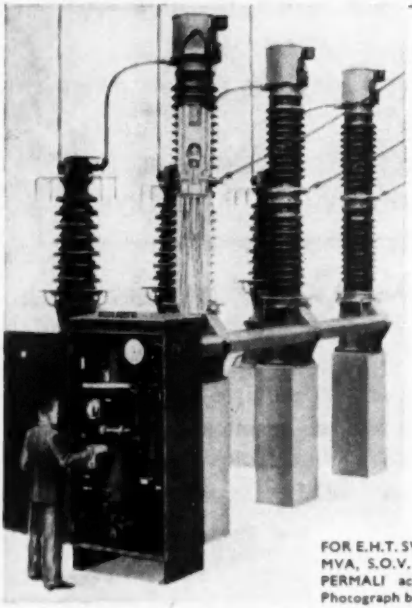

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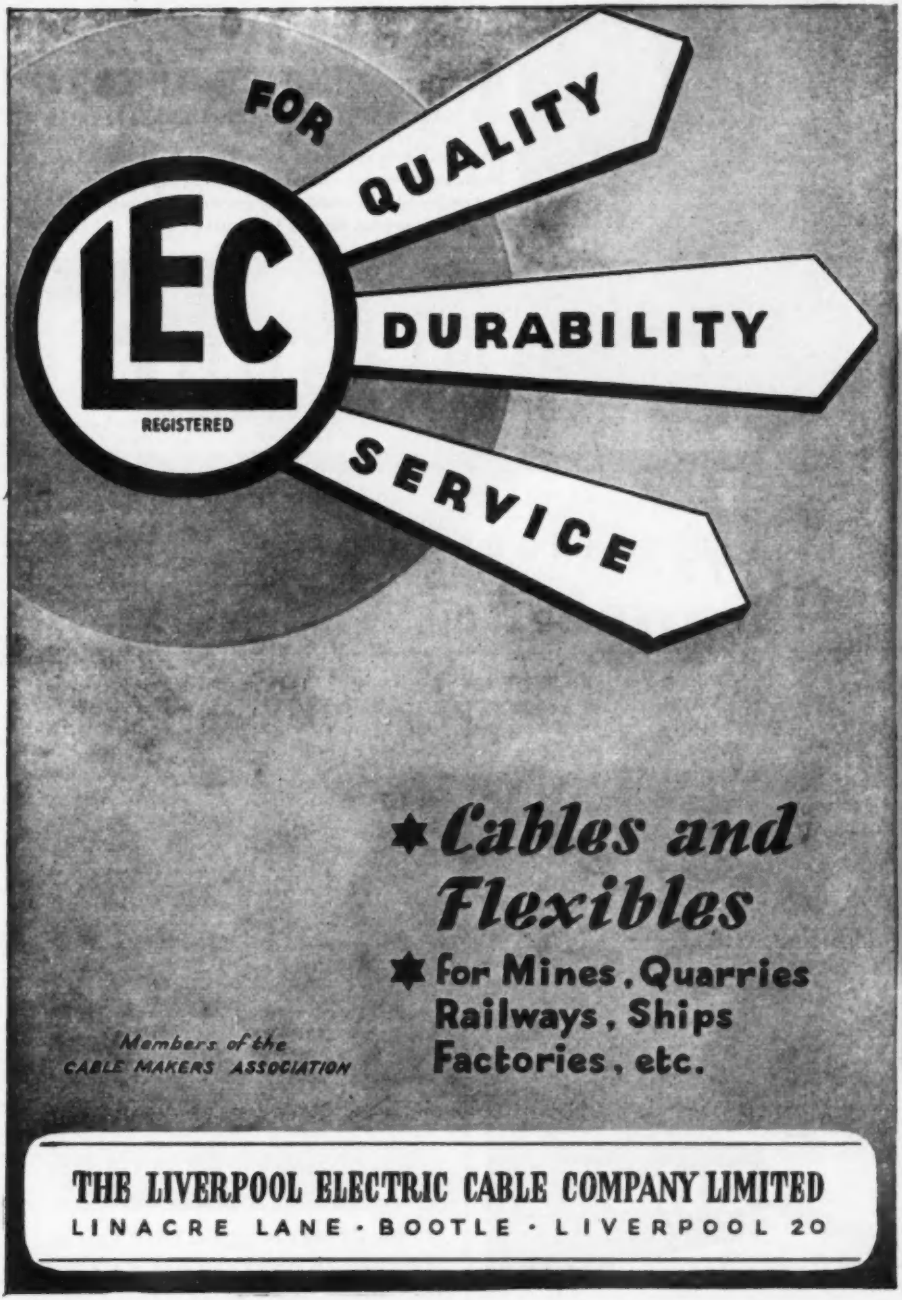
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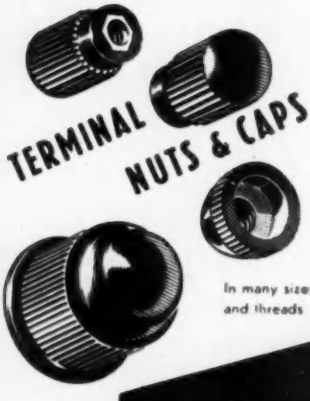

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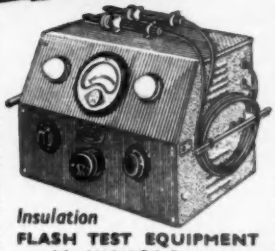

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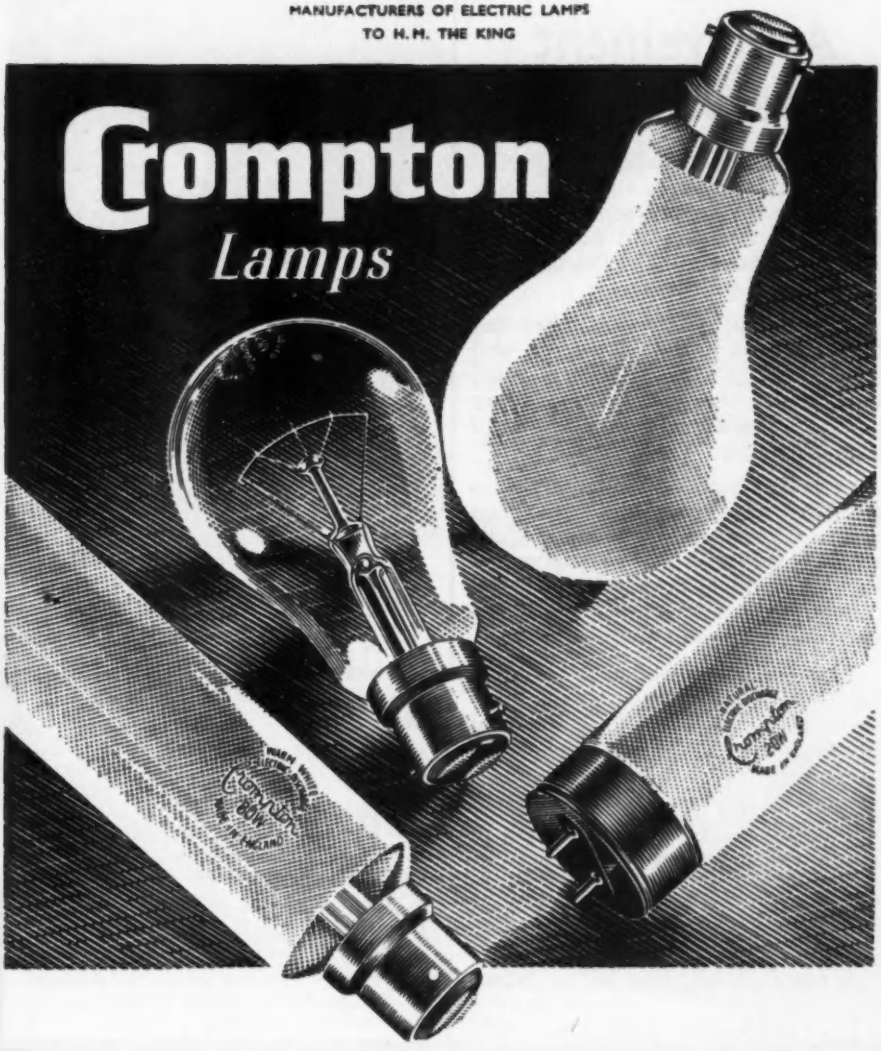

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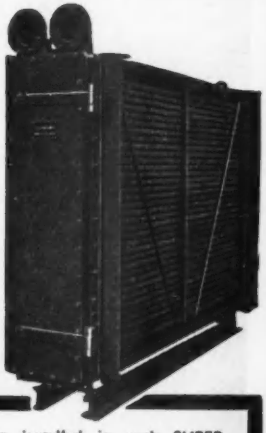

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Complete RECTIFIER SUBSTATION EQUIPMENTS comprising

Hewittic Rectifiers

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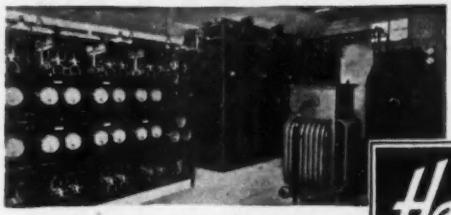
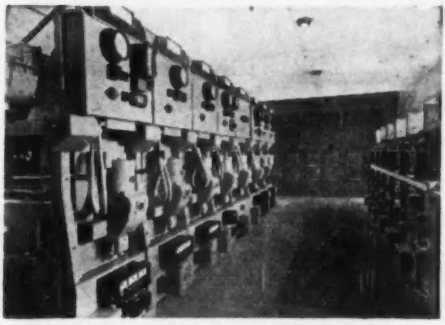
and associated switchgear



A complete Hewittic substation feeding a Light and Power Network in the London area. Equipment illustrated includes an induction regulator for voltage control, main transformer and D.C. switchgear.



A substation on the Midland Region of British Railways, with Hewittic Rectifier (centre), H.V. switchboard (left) and high-speed D.C. switchgear (right)—all supplied and installed by Hackbridge and Hewittic Electric Co., Ltd.

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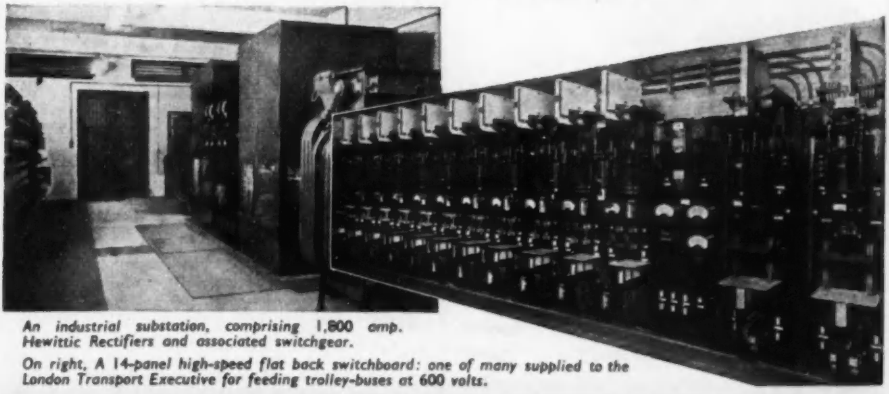

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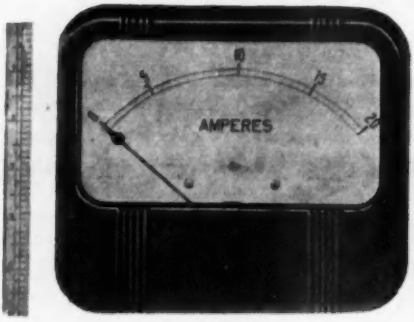

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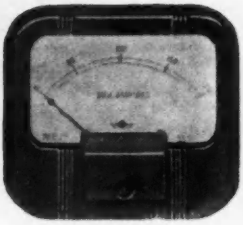

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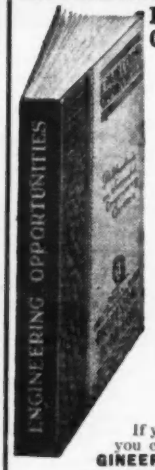

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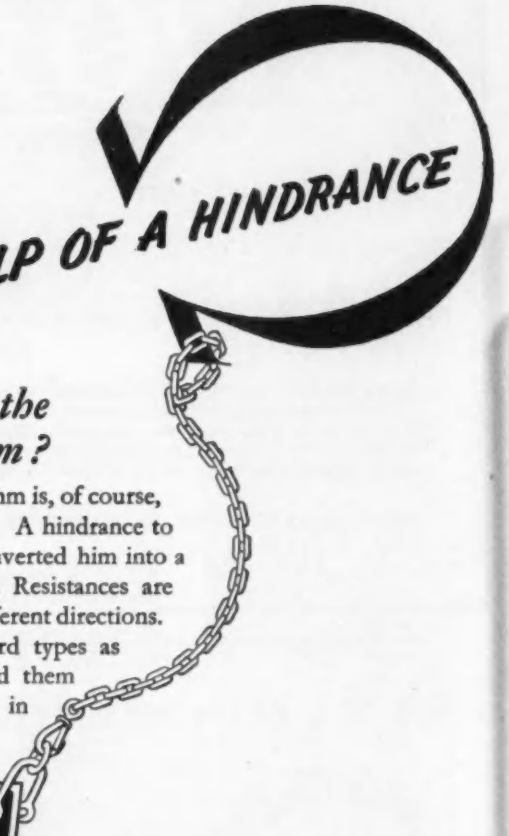

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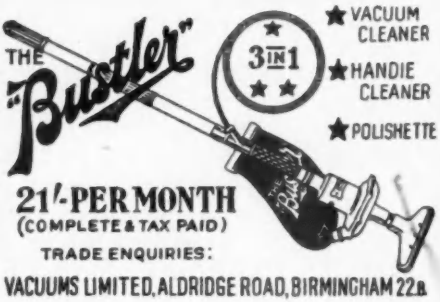

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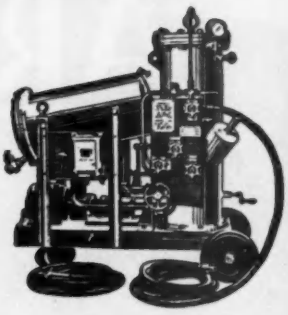

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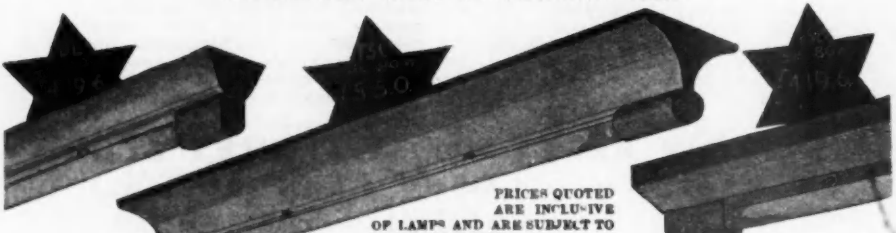

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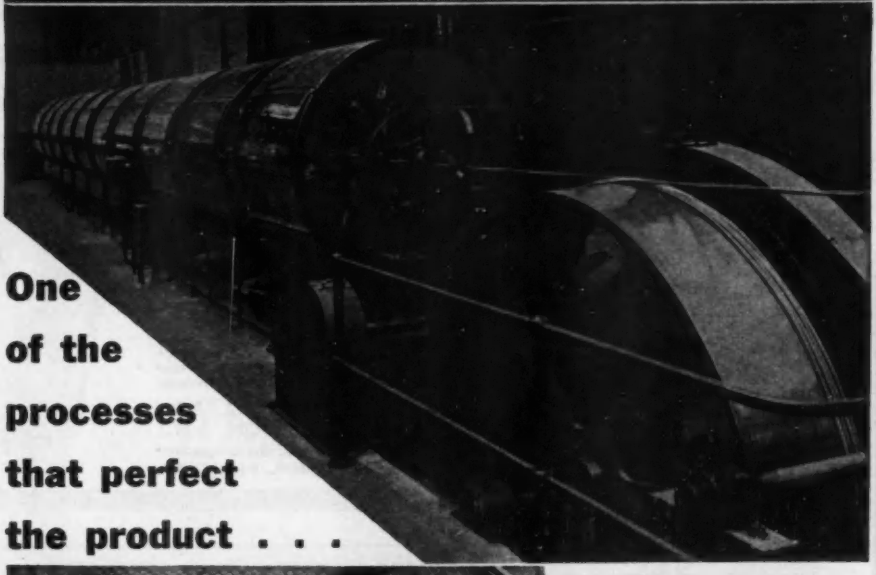

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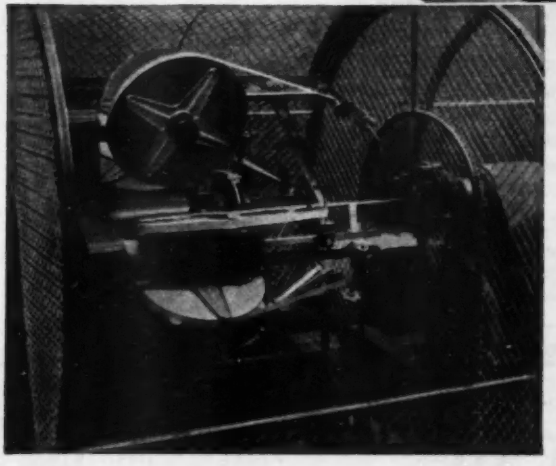

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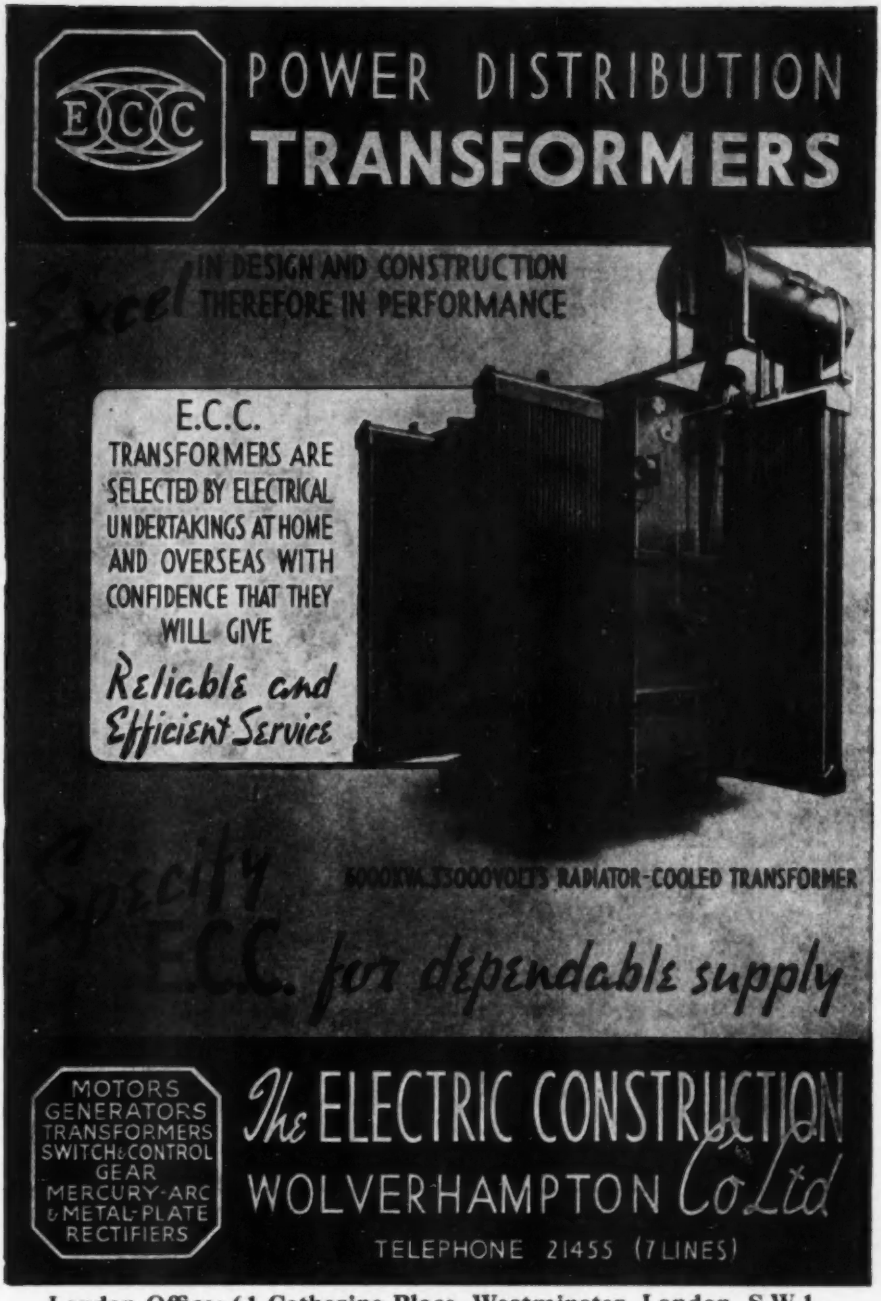

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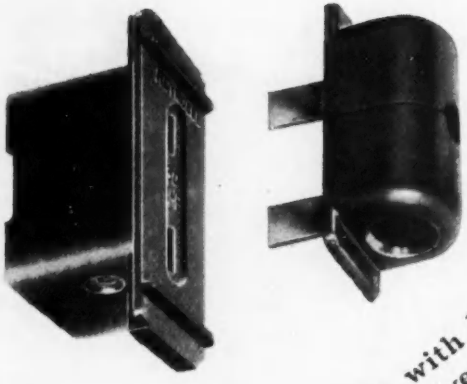

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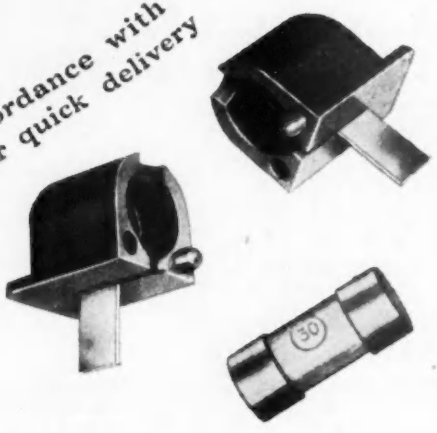

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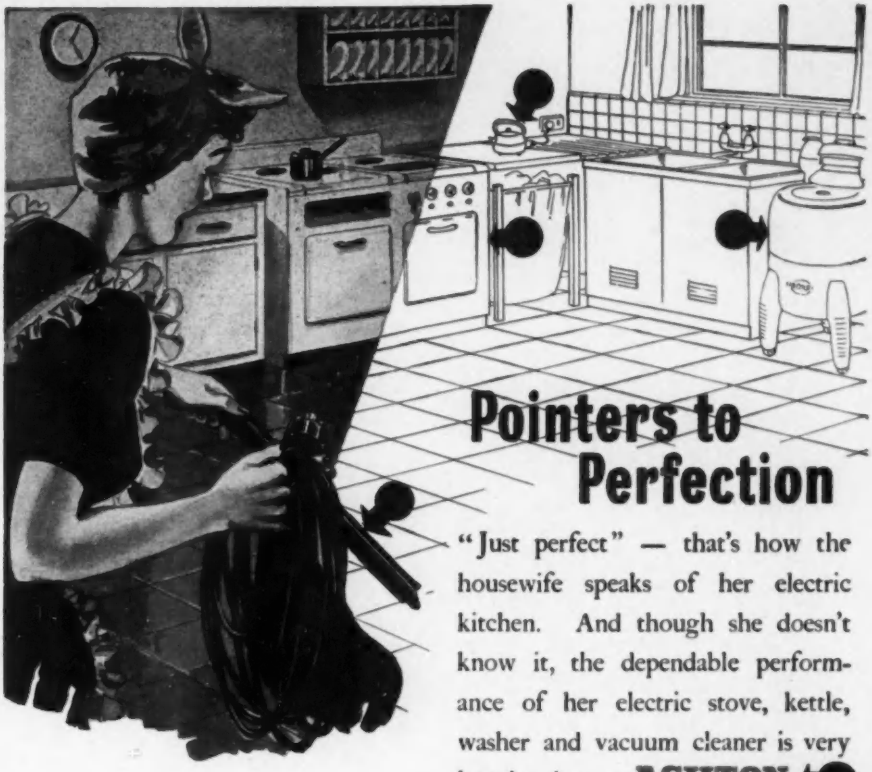

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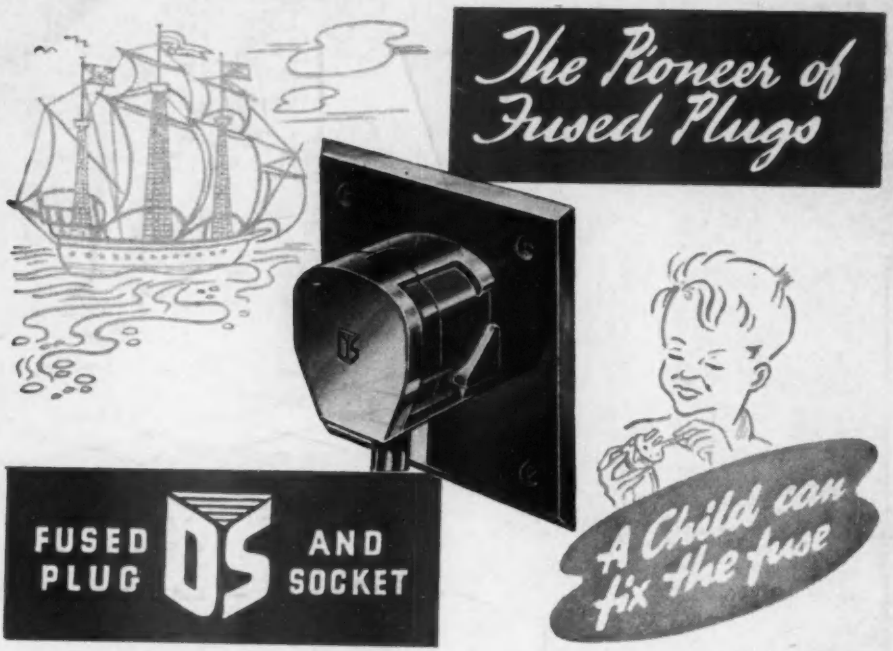

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